

Angus Council

Angus Shoreline Management Plan SMP2

Appendix G – Policy Scenario Testing



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The Supporting Appendices

These appendices and the accompanying documents provide all of the information required to support the Shoreline Management Plan. This is to ensure that there is clarity in the decision-making process and that the rationale behind the policies being promoted is both transparent and auditable. The appendices are:

A: SMP2 Development	This reports the history of development of the SMP2, describing more fully the plan and policy decision-making process.
B: Stakeholder Engagement	All communications from the stakeholder process are provided here, together with information arising from the consultation process.
C: Baseline Process Understanding	Includes baseline process report, defence assessment, NAI and WPM assessments and summarises data used in assessments.
D: Strategic Environmental Assessment (SEA) Environmental Report	This report identifies and evaluates the baseline environmental features (human, natural, historical and landscape) and presents an overview of the environmental assessment process, showing how the requirements of the EU Council Directive 2001/42/EC (the Strategic Environmental Assessment Directive) are met.
E: Issues & Objectives Evaluation	Provides information on the issues and objectives identified as part of the Plan development, including appraisal of their importance.
F: Policy Development and Appraisal	Presents the consideration of generic policy options for each frontage, identifying possible acceptable policies, and their combination into 'scenarios' for testing. Also presents the appraisal of impacts upon shoreline evolution and the appraisal of objective achievement.
G: Policy Scenario Testing	Presents the policy assessment and appraisal of objective achievement towards definition of the Preferred Plan (as presented in the Shoreline Management Plan document).
H: Economic Appraisal and Sensitivity Testing	Presents the economic analysis undertaken in support of the Preferred Plan.
I: Habitat Regulations Assessment	Presents an assessment of the effect the plan will have on European sites.
J: Water Framework Directive Assessment	Presents the Water Framework Directive assessment of the potential hydromorphological changes and consequent ecological impact of the preferred SMP2 policies.
K: Metadatabase and Bibliographic database	All supporting information used to develop the SMP2 is referenced for future examination and retrieval.

Within each appendix cross-referencing highlights the documents where related appraisals are presented. The broad relationships between the appendices are illustrated below.

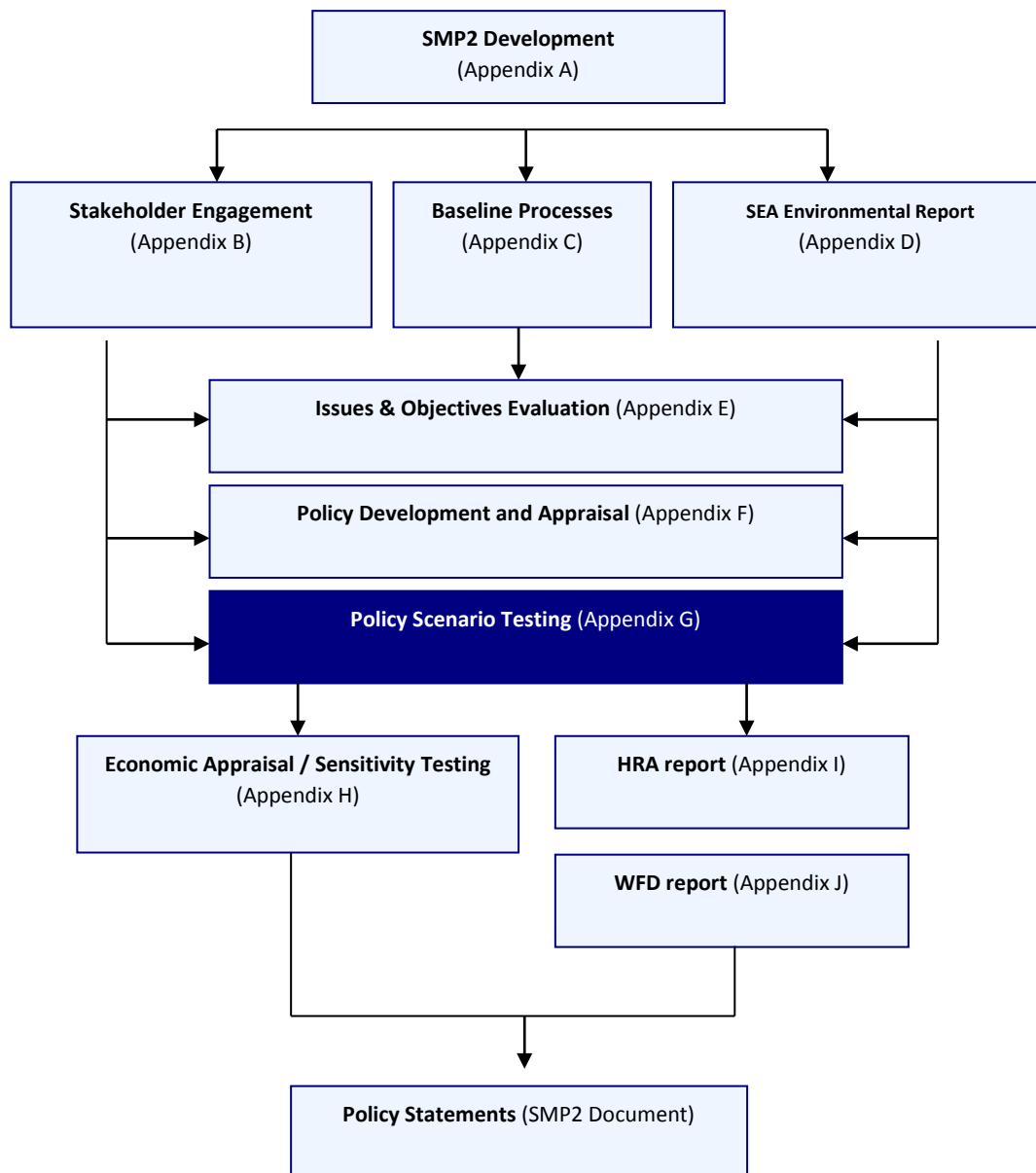


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G1 Introduction

This document identifies potential policy options that were appraised to assess likely future coastal change, impact on coastal features, impact on the environment, socio-economic impact and whether they achieve the SMP2 objectives. This will enable preferred SMP2 policies to be identified, which will guide future management of the Angus shoreline.

The shoreline management policies considered are those defined in the SMP2 guidance (Defra, 2006):

- **Hold the existing defence line** by maintaining or changing the standard of protection. This policy includes scenarios where work or operations are carried out seaward of the existing defences (such as beach recharge, rebuilding the toe of a structure or building offshore breakwaters) to improve, maintain or change the standard of protection provided by the existing defence line. This policy also includes operations landward of the existing defences (such as the construction of secondary flood walls) where they form an essential part of maintaining the current coastal defence system.
- **Advance the existing defence line** by building new defences on the seaward side of the original defences. This policy is limited to those policy units where significant land reclamation is considered.
- **Managed realignment** by allowing the shoreline to move backwards or forwards, with management to control or limit movement (such as reducing erosion or building new defences on the landward side of the original defences). Managed realignment has been assigned to all dune areas since it is not sustainable to artificially fix a line of dunes.
- **No active intervention**, where there is no investment in coastal defences or operations.

SMP2 guidance requires that the appropriateness of the SMP policies needs to consider any changes over time at each location (i.e. through considering the three time periods (0 to 20 years, 20 to 50 years and 50 to 100 years) as well as to account for interactions between locations along the coast). To clarify what each policy means for future management of the coast at the local scale, assumptions have been made regarding the likely implementation measures that would be used to achieve these policies.

The recommended approach for development of a sustainable final plan is through the assessment of policy scenarios, rather than considering locations in isolation (Defra, 2006). A 'nested' approach has therefore been adopted, to enable local issues to be addressed in developing policy, whilst still ensuring that larger scale considerations are still taken into account.

As part of this nested approach, the coast has been sub-divided into eight Policy Scenario Areas which are broadly based on the Coastal Process Unit (CPU) divisions described in **Appendix C**. These provide the highest tier in the approach, within which combinations of policy options have been developed for groups of Management Units (MU). The development of the policy scenarios to test has been described in more detail in **Appendix F**.

This Appendix describes the two main stages of work to assess the policy scenarios:

- Assessment of **shoreline interactions and response (Section G.2)** - investigate impact on shoreline interactions and future coastal evolution, drawing upon the baseline processes understanding and the 'no active intervention' and 'with present policies' baseline scenario assessments (**Appendix C**).
- Assessment of **achievement of objectives (Section G.3)** - assess the likely impact on coastal features and achievement of SMP2 objectives (**Appendix E**).

The choice of the most appropriate policies needs to take account of technical, environmental and socio-economic factors, in line with the Government's strategy for coastal erosion and flood risk management. Although the SMP2 should be flexible enough to adapt to changes in legislation, politics and social attitudes, it needs to be realistic and based on current legislation. **It should also be recognised that a policy to hold the line for a frontage does not mean guaranteed funding and issues of affordability and prioritisation of defence schemes may become more pronounced in the future.** Local factors also need to be considered to ensure that policies are the most appropriate to particular areas and circumstances.

From these appraisals, preferred policies were developed for each Management Unit and for each time period (up to 20 years, 20 to 50 years and 50 to 100 years).

This appendix should be read in conjunction with **Appendix D: SEA Environmental Report, Appendix I: Habitats Regulations Assessment, Appendix J: Water Framework Directive Assessment** and **Appendix H: Economic Appraisal and Sensitivity Testing.**

G2 Shoreline Interaction and Response Assessment

The first appraisal of alternative policy options undertaken involved the identification of potential impacts on future coastal evolution and behaviour, drawing upon the baseline processes understanding and the 'no active intervention' (NAI) and 'with present policies' (WPP) baseline scenario assessments (see **Appendix C**);

For each of the Coastal Process Units and Management Units, tables have been provided identifying the alternative policy options/ scenarios that have been considered, together with a brief justification to support why these alternatives have been selected. This states the broad assumptions made regarding the implementation of the policy options. This is necessary to inform the assessment of potential impacts, but does not remove the requirement for further, more detailed, study, which would be undertaken at a strategy/ scheme stage.

The tables are followed by an analysis of the potential impact of the alternative policies on coastal evolution and therefore future coastal erosion and flood risk. This analysis builds upon the understanding of coastal behaviour and potential evolution presented in **Appendix C: Baseline Process Understanding**. Appendix C also provides further background information on the broad scale assumptions made in this SMP review, with respect to future coastal response and discusses assumptions made with regard to future climate change, including sea level rise (Section C3.2: Consideration of Future Climate Change).

In order to sensibly assess potential shoreline response for each of the proposed scenarios, assumptions regarding the likely implementation measures that would be used to achieve these policies were made. At this stage, the Management Units were more or less defined and therefore the locations are broadly applicable to the final Management Units presented in SMP2.

G2.1 Montrose

G2.1.1 Policy Scenarios assessed and assumptions

Table G2.1 Montrose Policy Scenarios assessed and associated assumptions

SMP 2 Management Unit (MU)	SMP 1 policy	SMP 2 Policy Scenarios						Justification	
		Policy Scenario A			Policy Scenario B				
		0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs		
1.1	Montrose Bay (Milton Ness to Montrose Links)	No active intervention (limited intervention if dune erosion becomes an issue)	Allow the cliff and dune system to evolve and retreat naturally, through no active intervention .			As Policy Scenario A			<p>The currently undefended, naturally evolving dune system in Montrose Bay is nationally environmentally designated, and allowing natural processes to continue is key to the conservation of the SSSI. There are minimal assets at risk of flooding and therefore there is unlikely to be sufficient economic justification to attract public funding of any future defences.</p> <p>The golf links are currently eroding; however, there is unlikely to be economic justification to defend the frontage using public funds, and the sustainability of defending is questionable.</p> <p>GlaxoSmithKline has been identified as a Key Policy Driver and economics are likely to justify continued defence in this area due to the industrial/commercial assets in flood / erosion risk area.</p> <p>The other main assets at erosion risk are the Splash recreation area and South Links Holiday Park. There is an opportunity to remove defences to allow a more natural shoreline alignment to form, to provide a release of sediment back into the system to feed beaches and to reinstate the dunes as a natural line of defence.</p> <p>Under rising sea levels coastal squeeze along defended frontages may result in further loss of beaches in the long term, therefore restoring / stabilising the upper beach and dune system as a natural form of defence will be important in the future.</p>
1.2	Montrose Golf Links	No active intervention (limited intervention, retreat in the short term)	Enable the dune system to function naturally with minimal interference, but allow localised dune management if necessary to maintain the integrity of the dunes, through managed realignment and monitoring. Set-back of some parts of the Golf Course will be required. Potential for beneficial use of River South Esk dredged material along the frontage as part of the scheme (in line with Milne and Dong, 2011).			As Policy Scenario A			
1.3 (a)	Splash (The Faulds)	Hold the line	Hold the line through maintaining and upgrading the existing defences and restoring / stabilising the upper beach. Potential for beneficial use of River South Esk dredged material along the frontage as part of the scheme (in line with Milne and Dong, 2011).			Remove current defences and enable the dune system to function naturally with minimal interference, but allow dune management if necessary, through managed realignment and monitoring. Potential for beneficial use of River South Esk dredged material along the frontage as part of the scheme.			
1.3 (b)	South Links Holiday Park		Hold the line through maintaining and upgrading the existing defences and restoration / stabilisation of the upper beach. Potential for beneficial use of River South Esk dredged material along the frontage as part of the scheme (in line with Milne and Dong, 2011).			Remove current defences and enable the dune system to function naturally with minimal interference, but allow dune management if necessary, through managed realignment and monitoring. Potential for beneficial use of River South Esk dredged material along the frontage as part of the scheme.			
1.4	GlaxoSmithKline		Hold the line through maintaining and upgrading the existing defences and restoration / stabilisation of the upper beach if required. Potential for beneficial use of River South Esk dredged material along the frontage as part of the scheme (in line with Milne and Dong, 2011).			As Policy Scenario A			

G2.1.2 Appraisal of potential impacts on coastal behaviour and shoreline evolution

Policy scenario A

Short term (up to 20 years)

Assuming current conditions continue, sediment input to this coastline will be limited to erosion of the dunes along the southern part of the Bay. There is unlikely to be any significant input of beach sediments from the two rivers or from further offshore. There is also unlikely to be any appreciable longshore transport of beach sediment past the headlands to the north and south or out of the bay. Within most of Montrose Bay, net drift is to the north; however there is a drift divide along the Splash frontage, where material is also transported to the south due to the strong tidal currents in the vicinity of the River South Esk mouth.

Under a no active intervention policy, negligible rates of erosion are likely to continue along the currently undefended volcanic cliff frontage to the north of Montrose Bay, although localised rock falls could result in several metres of isolated recession at any one location at any time.

Continued beach accretion along the St Cyrus frontage is expected, providing natural dune protection. Erosion of the dune ridge during storms will provide minimal input of sediment to the enclosed system of Montrose Bay. Localised patterns of erosion and accretion will depend on the wave climate, and changes in the wave climate may affect sediment drift rates, directions and erosion and accretion patterns within the bay. Natural movement and reorientation of the River North Esk channel will continue; the southern spit is likely to grow northwards under present wave climate conditions. Erosion rates for dunes to the south of the River North Esk mouth are likely to continue as present, with rates increasing from north to south.

Continued erosion of the steeply faced dunes along the Montrose Links frontage is expected although this is likely to be variable year on year and rates will be dependent on the wave climate and resultant longshore transport (drift). Under a managed realignment policy, those sections of the golf course at risk of erosion would need to be relocated further inland, following which, the two remaining rock armour strong points would be removed. There will be rapid erosion of the dunes back to the more natural adjacent shoreline position which will result in a release of sediment back into the beach system. Following which, the dune system will be allowed to function naturally as the natural line of coastal defence, with minimal interference. Localised dune management, such as re-profiling the dunes or use of dune fencing to encourage sand accumulation at the dune toe, may be required to maintain the integrity of the dunes and to help manage erosion. Any dune management work undertaken should however, not restrict the net movement of sediment north.

Increased localised erosion / cutback of dunes immediately to the north of Splash is expected due to the outflanking of hard defences at Splash and associated restriction of sediment movement north in this location due to the limited supply of sediment.

The construction of defences at Splash has led to significant modification of the natural shoreline in this area, where defences artificially hold the shoreline approximately 40-60m seaward of its natural position, preventing natural coastal retreat. The presence of defences at both Splash and in front of South Links Holiday Park, and the unnatural alignment of the coast in this location, will result in lowering of the beach. There is however, potential to place dredged material from the River South Esk onto the beach (Milne and Dong, 2011) here and in front of the golf links to help restore / stabilise the upper beach in these locations through beach recharge. Material placed in front of the Splash seawall could also benefit both frontages to the north and south. There will however, be a need to consider how this material is retained on the beach without impacting on potential longshore sediment movement to the north and to the south.

The GlaxoSmithKline frontage is likely to remain stable as the recharged beach, dune planting and groyne system helps retain sediment in this location.

Medium term (20 to 50 years)

To the north of Montrose Bay, slow erosion of resistant cliffs is expected to continue, although there is a risk that several metres of localised erosion could occur due to rock falls at any one location. Sea level rise may result in narrowing of the fronting rock platform during this period, although it is not likely that this will lead to an acceleration of erosion rates. The pocket beach at the north of the frontage (near Rock Hall Fishing Station) may begin to narrow as sea levels rise.

Within Montrose Bay, a continuation of erosion and accretion patterns (erosion south, accretion north) is expected to continue unless the wave climate / drift patterns change. With rising sea levels, some beach lowering and frontal dune erosion would be expected to result over time. Assuming present conditions continue, this material will be redistributed north and, as a result, accretion is likely to continue north of the River North Esk outlet. The mouth of the River North Esk is likely to continue to naturally move and re-orientate over time. Erosion of dunes to the south of the River North Esk mouth is likely to continue, at a rate similar to present, with rates increasing from north to south.

Montrose Links dunes will be allowed to evolve naturally with limited intervention. Frontal erosion of the dunes will continue; however erosion is likely to be variable being highly dependent on wave climate and direction of littoral transport. Localised dune management, such as the methods described above, may be required to maintain the integrity of the dunes, to help manage erosion. Increased localised erosion / cutback of dunes immediately to the north of Splash is expected to continue. Measures to address this outflanking, such as a localised rock revetment may be required; however this may just act to move the outflanking issue further north.

Narrowing and lowering of the beach in front of defences at Splash and in front of South Links Holiday Park will continue with sea level rise. Wave overtopping and therefore flood risk to assets will increase over time. Beach recharge may help maintain beach levels and standards of protection along the frontage as well as provide material to feed beaches to the north and south of Splash. There is potential to use dredged material from the River South Esk for this purpose. However, if groynes are used to help keep this material on the beach, sediment movement north and south of the drift divide will be restricted and the potential for further erosion to the north and south would increase.

As long as sediment movement south is not restricted, the beach fronting GlaxoSmithKline is likely to remain stable as groynes continue to help maintain a wider beach in this location. If sediment movement is restricted, stability will be compromised and the beach may experience lowering as sea levels rise.

Long term (50 to 100 years)

Low rates of cliff erosion are anticipated in the north of Montrose Bay; however there is a risk of several metres of erosion as a result of individual rock fall events in localised areas. The resistant nature of the cliffs will remain the dominant control on their erosion and therefore recession rates are not expected to be significantly affected by accelerated sea level rise. There is potential for loss of the pocket beach to the north where it is unable to retreat due to the resistant cliffs behind. The rock platform fronting the cliffs may become submerged.

A continuation of erosion and accretion patterns is expected in Montrose Bay, unless the wave climate / drift patterns change (erosion south, accretion north). Accretion is likely to continue north of the River North Esk outlet. Natural movement and reorientation of the River North Esk channel will occur. South of the River North

Esk outlet, sea level rise would be expected to result in some beach narrowing and frontal dune erosion over time. Erosion of dunes to the south of the River North Esk mouth is likely to continue, with rates increasing from north to south. There is however, potential for these rates to increase over this epoch due to the reduced sediment supply resulting from the continued defence of Splash to the south.

Continued erosion of the frontal dunes and golf course at Montrose Links is predicted to occur, as sea levels rise and as a result of the reduced sediment supply from the south. However, there is potential for the dunes to reach a more stable position over time. Ongoing dune management, as described above, is likely to be required over this epoch to maintain the integrity of the dunes as a natural defence line and to manage erosion.

As sea levels rise, the beaches in front of Splash and South Links Holiday Park will lower and narrow against the defences. To maintain the hold the line policy to the south, more substantial defences may be required to maintain standards of protection and address increased overtopping frequency along this frontage. Further recharge campaigns combined with beach retaining structures may help to encourage sand accumulation and maintain beach levels along this southern frontage. This may however, have knock-on effects to the south, causing erosion along the GlaxoSmithKline frontage as a result of a restricted sediment supply.

Policy scenario B

This scenario considers the impact of undertaking managed realignment along the Splash and South Links Holiday Park frontages.

Short term (up to 20 years)

The central and northern shorelines of Montrose Bay will behave as for Scenario A.

Under a policy of managed realignment, removal of current defences at Splash and at South Links Holiday Park will enable the dune system to evolve more naturally and restore its function as the coastal defence. Following defence removal, there could be initial rapid erosion of dunes, back to a more natural position, as the shoreline currently lies seaward of the adjacent Montrose Links coastline to the north.

Previously stored sediment will be released to fronting and adjacent beaches to the north and south, which should help maintain the stability of the GlaxoSmithKline beach to the south. In conjunction with management of the Montrose Links dune system to the north, localised dune management, such as dune reprofiling or dune fencing to encourage sand accumulation at the dune toe, could help maintain the integrity of the dunes and manage erosion with minimal interference. There is potential for use of dredged material from the River South Esk as beach recharge to form part of the scheme along this frontage.

Medium term (20 to 50 years)

The central and northern parts of Montrose Bay shoreline are predicted to behave as for Scenario A.

The southern dune system will be allowed to evolve more naturally with limited intervention. Frontal erosion of the dunes will continue; however, erosion is likely to be variable being highly dependent on wave climate and direction of littoral transport. Beach volumes within the groyne bays at the GlaxoSmithKline works may remain stable with the potential new supply of sediment from erosion of adjacent dunes immediately north.

There is potential to continue to use dredged material from the River South Esk as part of beach recharge schemes along the southern frontage to help stabilise and maintain the upper beach.

Long term (50 to 100 years)

The central and northern parts of Montrose Bay shoreline are predicted to behave as for Scenario A.

Frontal dune erosion will continue in the south towards the GlaxoSmithKline site as sea levels rise. Ongoing dune management, as described above, is likely to be required over this epoch to maintain the integrity of the dunes as a natural defence line and to manage erosion in line with the Montrose Links dunes to the north. With a continued sediment supply from immediately north, the GlaxoSmithKline frontage may remain stable; however, the beach may narrow against defences as sea levels rise.

Over the long term the northern edge of the GlaxoSmithKline site may begin to protrude seaward as the dune system to the north erodes back along a more natural alignment. There is potential therefore for cutback of dunes immediately to the north of GlaxoSmithKline in the long term due to outflanking of hard defences at GlaxoSmithKline.

Key assumptions/ uncertainties

Although the level of risk posed by isolated cliff falls to the north of Montrose Bay is believed to be low, this assumption is based upon very limited data on cliff recession rates. Ongoing monitoring would reduce this uncertainty and would therefore be recommended, particularly where assets may be at potential risk.

The Montrose Bay dune system is assumed to be fairly resilient. Current patterns of accretion and erosion are likely to continue.

Under policy scenario A, the impact of defences on alongshore drift and therefore on adjacent shorelines is uncertain, due to limited data relating to actual littoral drift rates. The scale of impact may also depend upon the design/form of any new structures.

Assumes dredging of the River South Esk channel continues and will be available / suitable for beach recharge.

The accompanying objectives appraisal for Scenario Area 1 – Montrose is included in Section **G3.1 Montrose**.

G2.2 Montrose Basin

G2.2.1 Policy Scenarios assessed and assumptions

Table G2.2 Montrose Basin Policy Scenarios assessed and associated assumptions

SMP 2 Management Unit (MU)	SMP 1 policy	SMP 2 Policy Scenarios						Justification	
		Policy Scenario A			Policy Scenario B				
		0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs		
2.1 (a)	Montrose Port (north bank – Glaxo to A92 bridge)	Hold the line	Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			<p>The railway line, road infrastructure and a number of residential and commercial facilities at Montrose and Montrose Port are potentially at risk from flooding due to sea level rise. Therefore a key driver is to reduce the risk of coastal flooding to these assets. Economics are likely to justify continued defences in these locations.</p> <p>The other main assets at risk within the Basin are the residential areas at Tayock, Rossie island and Ferryden. Continued protection in these locations may only mean limited intervention is required for reducing risk to properties during extreme conditions. Montrose Basin is internationally designated as a SPA and Ramsar site and loss of the designated intertidal habitat will mean that secondary compensation habitat is likely to be required to provide replacement habitat for Ramsar/SPA birds and other noted Ramsar interests.</p> <p>Much of the western edge of the basin and along the edge of the flood plain of the River South Esk has been reclaimed for agriculture and is currently protected by embankments. There are potential opportunities and technical benefits to implementing managed realignment in this area for habitat creation and to provide accommodation space under rising sea levels.</p>
2.1 (b)	Montrose Port (south bank – A92 bridge to Ferryden)		Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			
2.2 (a)	Montrose West (A92 Bridge to the end of railway defences)	Selectively Hold the Line: Managed Realignment (part) / Hold the line (part) / No active Intervention (part)	Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			
2.2 (b)	Montrose West (Railway defences to Tayock River)		Hold the line through maintenance of existing defences and limited intervention, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			
2.3 (a)	Tayock (Tayock village)		Hold the line through maintenance of existing defences and limited intervention, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			
2.3 (b)	Tayock (Sleepyhillock Cemetery)		Hold the line through maintenance of existing defences and limited intervention, to ensure that the risk of flooding and erosion is managed.			Allow existing defences to fail and allow the coast to evolve and retreat naturally, through no active intervention .			
2.4	West Montrose Basin (west of Tayock to Old Montrose)		Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			Construct a new set back defence through managed realignment and then maintain these new defences to ensure that the risk of flooding is managed.			
2.5	Old Montrose to Railway Bridge	Allow the coast to evolve naturally through no active intervention .			As Policy Scenario A				
2.6	Rossie Island to A92	Hold the line through maintenance of existing defences and limited intervention, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A				
2.7	Ferryden	Selectively Hold the Line: Hold the line (Ferryden) / No active Intervention (part)	Hold the line through maintenance of existing defences and limited intervention, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			
2.8	Ferryden to Scurdie Ness		Allow the coast to evolve naturally through no active intervention .			As Policy Scenario A			

G2.2.2 Appraisal of potential impacts on coastal behaviour and shoreline evolution

Policy scenario A

Short term (up to 20 years)

Littoral processes within Montrose Basin are dominated by tidal and river flows. The Basin acts as a trap (sink) to fine sediment being transported down the River South Esk and potentially to sand transported in on the strong flood tides from Montrose Bay.

Montrose Basin and its evolution is highly dependent on any changes in sediment supply and in channel position, which are difficult to predict and have the potential to affect shoreline exposure and erosion and accretion trends within the Basin. This could have significant effects on the evolution of the shoreline.

Assuming present conditions continue, Montrose Basin will continue to gradually silt up. This, combined with the sheltering effect of the Basin, suggests that the intertidal areas will remain relatively stable, albeit assuming that the low water channels do not move significantly within this period. Assuming a continued supply of sediment from the River South Esk and Montrose Bay, saltmarsh accretion / stability is expected within the Basin.

Maintenance of defences at Montrose, Tayock, Rossie Island and Ferryden, as well as along the railway and at Montrose Port would continue to ensure that the shoreline position is fixed and erosion and flood risk is managed. Over this period, it is unlikely that this would have a significant impact on changes within the Basin, due to the continued infilling and limited erosion rates.

Along the southern bank (Old Montrose to the railway bridge) there are limited assets at risk and the shoreline would be allowed to evolve naturally. Due to the rising ground and geology present, little change would be expected during this period; however there is potential for episodic erosion due to wave action during high tidal conditions.

Minimal erosion of the undefended cliffs between Ferryden and Scurdie Ness is expected.

Medium term (20 to 50 years)

Changes within Montrose Basin are difficult to predict, being dependent on changes in tidal prism, channel position and how the Basin responds to rising sea levels. However, assuming continued sedimentary infilling, it is predicted that the Basin as a whole will maintain its overall stability under a scenario of future sea level rise. Rates of accretion may slow in response to sea level rise, although it is assumed that sediment inputs would be sufficient to prevent the trend reversing to one of erosion. There may also be changes in channel position which would have impacts on the shoreline, but these are difficult to predict.

Much of the eastern, northern and western shoreline within Montrose Basin would remain fixed during this period in order to manage the flood and erosion risks to residential and commercial assets and infrastructure. There will, however, be increased risk of wave overtopping of defences during storm events, (assuming no improvements are made) as sea levels rise and with climate change.

Along the southern bank the shoreline would be allowed to evolve naturally and little change would be expected during this period; however there is potential for occasional erosion by wave action during high tidal conditions.

It is not expected that sea level rise will significantly affect the rate of recession of the undefended cliffs between Ferryden and Scurdie Ness due to their resistant nature. However, sea level rise may start to submerge the fringing rock platform and shingle fringing beach.

Long term (50 to 100 years)

Future evolution of Montrose Basin is difficult to predict, particularly as the system responds to rising sea levels. Sediment accretion within the Basin would generally be expected to keep pace with sea level rise, due to the supply of sediment from both offshore and the River South Esk.

Much of the shoreline will continue to be fixed in order to manage flood and erosion risk to the railway and other assets. The defences are likely to require improvements during this period in order to maintain standards of flood defence as sea level rise accelerates. Increased overtopping of defences and potential flooding of properties is also likely with sea level rise.

Under a hold the line policy, there is potential for erosion and coastal squeeze of the intertidal area against defences due to channel movements and, over time, sea level rise.

On the southern bank the shoreline would be allowed to evolve naturally. There is increased potential for localised episodic erosion of the coastal edge by wave action during high tidal conditions.

From Ferryden to Scurdie Ness, minimal erosion is predicted to occur by the end of this epoch, predominantly through localised cliff falls. There is potential for loss of the shingle fringe beach where it is unable to retreat due to the resistant cliffs behind, and the rock platforms fronting the cliffs may become submerged. However, the resistant nature of the cliffs will remain the dominant control on their erosion and therefore recession rates are not expected to be significantly affected by accelerated sea level rise.

Policy scenario B

This scenario considers the impact of implementing a no active intervention policy at Sleepyhillock Cemetery and undertaking managed realignment along the western Montrose Basin frontage.

Short term (up to 20 years)

The eastern and southern banks of Montrose Basin are predicted to behave as for Scenario A.

The Sleepy Hillock frontage would be allowed to evolve naturally following defence failure. Due to the rising ground and geology present, little change would be expected during this period; however there is potential for episodic erosion due to wave action during high tidal conditions.

In the west of the Basin, a set-back defence would be constructed and the current embankments would be allowed to fail. This would lead to an area of previously reclaimed land reverting to a more natural environment and creating new intertidal areas. The lateral extent of flooding will be limited by higher land or new set-back defences. Flows into and out of these new intertidal areas would create new channels or result in the expansion of the existing creek network. Under a managed realignment policy, there is potential for the Basin to increase in size by around a third, dependant on the location of set-back defences. As a result, there would be a significant increase in tidal prism and therefore, flows and water levels in the Basin may also increase.

Medium term (20 to 50 years)

The eastern and southern banks of Montrose Basin are predicted to behave as for Scenario A.

The Sleepyhillock Cemetery shoreline would be allowed to evolve naturally and little change would be expected during this period; however there is potential for episodic erosion by wave action during high tidal conditions.

Under a managed realignment policy in the west of the Basin, new habitats will be created in new intertidal areas. This could result in further changes to river flow patterns and sediment movement. Increased flows at the mouth of the River South Esk, south of Montrose, may put additional pressure on defences in this location.

Long term (50 to 100 years)

The eastern and southern banks of Montrose Basin are predicted to behave as for Scenario A.

The northern shoreline at Sleepyhillock Cemetery would be allowed to evolve naturally. There is increased potential for episodic erosion of the coastal edge by wave action during high tidal conditions.

The set-back defences in the west would be maintained in order to continue managing flood and erosion risk to the hinterland. The habitat created through flooding of the previously reclaimed land may narrow as sea level rises and the set-back line is held.

Key assumptions/ uncertainties

Policies within Montrose Basin are generally sensitive to how the Basin is likely to evolve in the future. There is significant uncertainty regarding future response of the Basin to both sea level rise and climate change. Future evolution of the Basin will be sensitive to both changes in tidal prism and in the position of the low water channels. The cost of providing defences within the Basin will also be affected by any increase in water level and frequency of extreme events.

The east of this frontage is also dependent on future plans for the railway, which runs along sections of the Montrose shoreline, with the railway embankments often providing defence to the hinterland. It has been assumed in developing policies that the entire railway system will be maintained and will remain a key policy driver over the next century.

It is assumed that the port structures remain in place and are maintained.

The accompanying objectives appraisal for Scenario Area 2 – Montrose Basin is included in Section G3.2 Montrose Basin

G2.3 Scurdie Ness to Rickle Craig

G2.3.1 Policy Scenarios assessed and assumptions

Table G2.3 Scurdie Ness to Rickle Craig Policy Scenarios assessed and associated assumptions

SMP 2 Management Unit (MU)	SMP 1 policy	SMP 2 Policy Scenarios						Justification	
		Policy Scenario A			Policy Scenario B				
		0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs		
3.1	Scurdie Ness to Rickle Craig	Selectively Hold the Line: Hold the line (Railway) / No active Intervention (short term no active intervention)	Allow the cliffs to evolve and retreat naturally, through no active intervention , but allow implementation of localised defence measures if the railway is at risk of erosion in the future, subject to obtaining the necessary consents, licences and approvals.			-	-	-	<p>There are currently no defences along this frontage. The cliffs are designated as SSSI for their geology. A continuation of coastal processes is key to the conservation of the SSSI. There are minimal assets at risk of flooding / erosion and therefore there is unlikely to be economic justification to defend the frontage as a whole.</p> <p>A railway bridge crosses over two cliffs just south of Boddin Point. The railway line is identified as a Key Policy Driver and as such, local measures may be required if the railway is at risk in the future. Potential works are not expected to affect coastal processes, but may impact on the National designations. In addition, opportunities to re-route the railway line further inland on a more sustainable alignment should be investigated.</p>

G2.3.2 Appraisal of potential impacts on coastal behaviour and shoreline evolution

Policy scenario A

Short term (up to 20 years)

The undefended cliffs along the majority of this frontage, fronted by a fringing rock platform, have historically been experiencing low rates of erosion and these are predicted to continue with negligible erosion expected during this epoch, although localised rock falls could result in several metres of isolated recession at any one location.

Risk to the railway would be monitored, and defences would be constructed as necessary. Even without railway defences in place, it is unlikely that the shoreline would change significantly due to the resistant geology.

Small shingle pocket beaches will remain.

Medium term (20 to 50 years)

Low rates of cliff erosion are expected to continue during this epoch, although there is a risk that several metres of erosion could occur due to localised rock falls at any one location. However, it is not expected that sea level rise will significantly affect the rate of recession of cliffs along this frontage.

Risk to the railway would be monitored, and defences may be constructed as necessary.

Sea level rise may start to submerge the fringing rock platform and result in potential loss of some pocket beaches.

Long term (50 to 100 years)

Low rates of cliff erosion are predicted, although localised rock falls could result in several metres of isolated recession at any one location. However, the resistant nature of the cliffs will remain the dominant control on their erosion and therefore recession rates are not expected to be significantly affected by accelerated sea level rise.

Risk to the railway would be monitored, and defences could be constructed as necessary.

There is potential for loss of some pocket beaches where they are unable to retreat due to the resistant cliffs behind, and the rock platforms fronting the cliffs may become submerged as sea levels rise.

Key assumptions/ uncertainties

Although the level of risk posed by isolated cliff falls is believed to be low, this assumption is based upon very limited data on cliff recession rates. Ongoing monitoring would reduce this uncertainty and would therefore be recommended, particularly where assets may be at potential risk.

There are limited details on the level of the rock platforms and therefore the risk of them becoming permanently submerged as sea levels rise is uncertain.

It has been assumed in developing policies that the entire railway system will be maintained and will remain a key policy driver over the next century.

It has been assumed that there will be no further development within the erosion risk area.

The accompanying objectives appraisal for Scenario Area 3 – Scurdie Ness to Rickle Craig is included in Section **G3.3 Scurdie Ness to Rickle Craig**

G2.4 Lunan Bay

G2.4.1 Policy Scenarios assessed and assumptions

Table G2.4 Lunan Bay Policy Scenarios assessed and associated assumptions

SMP 2 Management Unit (MU)	SMP 1 policy	SMP 2 Policy Scenarios						Justification	
		Policy Scenario A			Policy Scenario B				
		0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs		
4.1	Lunan Bay	Selectively Hold the Line: Limited Intervention / Hold the Line (Corbie Knowe)	Allow the dune system to evolve and retreat naturally, through no active intervention .			As Policy Scenario A			<p>This is a largely undeveloped dune system where the main driver is to allow the system to evolve naturally, whilst recognising the possible need to manage visitor pressures and risk of sand blowouts.</p> <p>Pedestrian access pressures and other human activities over the dunes, from the car park just to the north of the outlet of Lunan Water, have resulted in destabilisation of the dune system with blowouts and other wind erosion features evident.</p> <p>There are, however, a number of local ad hoc defence structures at Corbie Knowe which protect a small community of holiday homes in the south of the Bay.</p> <p>Economics are unlikely to justify public funding of defences at Corbie Knowe in the future.</p>
4.2	Corbie Knowe		Allow existing defences to fail and allow the cliff and dune system to evolve and retreat naturally, through no active intervention .			<p>Hold the line through maintaining the existing defences until they reach the end of their effective life.</p>	<p>Allow existing defences to fail and allow the cliff and dune system to evolve and retreat naturally, through no active intervention.</p>		

G2.4.2 Appraisal of potential impacts on coastal behaviour and shoreline evolution

Policy scenario A

Short term (up to 20 years)

The Lunan Bay beach and dune system will continue to provide a natural form of defence to the backing agricultural land. Assuming present conditions continue, the shoreline position is likely to continue to be stable.

Periods of erosion of the upper beach and frontal dunes are likely to be linked to storm activity and may only affect certain sections of the frontage.

To the north of Lunan Water, destabilisation of dunes with blowouts may be exacerbated by wind erosion and anthropogenic pressures. Additional walkways, signage, viewing platforms and other measures could be implemented to limit these pressures.

Minor, natural, fluctuations of the position of the Lunan Water channel is likely to occur over time.

In the southern half of the bay, frontal dunes may be more vulnerable to wave attack during storms; however this may alter if the wave climate changes.

The trend for beach lowering at Corbie Knowe and the issue of outflanking of the defences to the north is expected to continue. Following failure / removal of defences, the local shoreline may erode back to a more natural alignment relatively quickly and then erosion rates are likely to low. Flood risk will increase to the remaining properties at Corbie Knowe.

Medium term (20 to 50 years)

The beach / dune system at Lunan Bay will continue to provide a natural form of defence to the backing agricultural land. The shoreline position is likely to continue to be stable with areas of erosion and accretion fluctuating along the bay.

Sea level rise and storm erosion will result in erosion of the frontal edge of the dunes. It is unlikely that this erosion will impact on farmland along the southern half of the bay or result in loss of property or historic interest at the mouth of the Lunan Water. Under a severe easterly storm, there is a risk of breaching of the dune ridge to the north of the Lunan Water outlet. This could lead to flooding of land, including the car park, and increased flood risk to property in the immediate hinterland.

Natural movement of the Lunan Water channel will continue.

Slow erosion at Corbie Knowe will continue and erosion risk to any remaining properties will increase.

Long term (50 to 100 years)

Erosion of the frontal edge of the dunes is expected to continue as sea levels rise. However, if dune erosion is significant, over time there is potential for a release of stored sediment as backing raised beaches and till cliffs are exposed. If this occurs fresh sediment will be provided to the beach and consequently beach composition may change and accretion may occur, resulting in a reversal of the erosive trend, despite sea level rise. This would not however, benefit other adjacent frontages as Lunan Bay is a closed sediment system. As the bay 'deepens' over time the area may become more sheltered.

Natural movement of the Lunan Water channel will continue.

Policy scenario B

This scenario considers the impact of implementing a hold the line policy at Corbie Knowe in the short term to allow for short term protection of properties along with the development of an adaptation strategy, followed by no active intervention in the medium and long terms.

Short term (up to 20 years)

The majority of the Lunan Bay shoreline is predicted to behave as for Scenario A.

Existing defences at Corbie Knowe will be maintained until they reach the end of their effective life. The trend for beach lowering in front of defences and outflanking of defences to the north will continue. Coastal defences are unlikely to prevent damage to frontal property and the immediate hinterland under a severe storm from the north-east. If a hold the line policy were to continue into the medium term, the defences would not have a significant effect, in terms of coastal processes. However, they would become more expensive and difficult to maintain as sea levels rise in the future.

Medium term (20 to 50 years)

Any remaining defences at Corbie Knowe would be allowed to fail or be removed. Following defence failure, the Lunan Bay and Corbie Knowe shoreline will behave as for Scenario A.

Long term (50 to 100 years)

The Lunan Bay shoreline will behave as for Scenario A.

Key assumptions/ uncertainties

The Lunan Bay dune system is assumed to be fairly resilient and current patterns of erosion and accretion experienced within the Bay are likely to continue. The dune system would, however, be vulnerable to any significant changes in the wind-wave climate - but there is a high level of uncertainty regarding this parameter. The dune system will also be vulnerable to any change in frontal dune stability, e.g. due to human pressure.

Uncertainty remains regarding the future behaviour of the Lunan Water outlet.

It has been assumed that there will be no further development within the coastal flood / erosion risk area.

The accompanying objectives appraisal for Scenario Area 4 – Lunan Bay is included in Section **G3.4 Lunan Bay**

G2.5 Lang Craig to Whiting Ness

G2.5.1 Policy Scenarios assessed and assumptions

Table G2.5 Lang Craig to Whiting Ness Policy Scenarios assessed and associated assumptions

SMP 2 Management Unit (MU)		SMP 1 policy	SMP 2 Policy Scenarios						Justification
			Policy Scenario A			Policy Scenario B			
			0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs	
5.1	Lang Craig to Whiting Ness	No active intervention	Allow the cliffs to evolve and retreat naturally, through no active intervention .			-	-	-	There are currently no defences along this frontage. The cliffs are designated as SSSI for their geology. Any introduction of defences would have a detrimental impact on these exposures and also on the natural landscape of this undefended coastline. Localised maintenance/ relocation of the footpath would need to be considered should sections of the path become at risk from isolated cliffs falls.

G2.5.2 Appraisal of potential impacts on coastal behaviour and shoreline evolution

Policy scenario A

Short term (up to 20 years)

The undefended cliffs along this frontage, fronted by a fringing rock platform, have historically been experiencing low rates of erosion and these are predicted to continue, with negligible erosion along the majority of the frontage expected during this epoch. There is, however, a risk that localised rock falls could result in several metres of isolated recession at any one location. Given the shelter provided by the cliffs flanking the beach areas formed in a number of small bays, and the protection provided by the rock platform, there is unlikely to be any significant change in beach processes or physical shape and form of this coastal frontage.

Medium term (20 to 50 years)

Low rates of cliff erosion are expected to continue along the majority of the frontage during this epoch, although there is a risk that several metres of erosion could occur due to localised rock falls at any one location. However, it is not expected that sea level rise will significantly affect the rate of recession of cliffs along this frontage, due to their resistant nature.

With sea level rise, the influence of the rock platform may reduce for longer periods of time as it becomes submerged.

Long term (50 to 100 years)

Low rates of cliff erosion are predicted along the majority of the frontage, although localised rock falls could result in several metres of isolated recession at any one location. However, the resistant nature of the cliffs will remain the dominant control on their erosion and therefore recession rates are not expected to be significantly affected by accelerated sea level rise.

There is potential for loss of some pocket beaches where they are unable to retreat due to the resistant cliffs behind, and the rock platforms fronting the cliffs may become submerged as sea levels rise. Material from rock falls is however, expected to remain at the toe of the cliff within the bays.

Key assumptions/ uncertainties

Although the level of risk posed by isolated cliff falls is believed to be low, this assumption is based upon very limited data on cliff recession rates. Ongoing monitoring would reduce this uncertainty and would therefore be recommended, particularly where assets may be at potential risk.

There are limited details on the level of the rock platforms and therefore the risk of them becoming permanently submerged as sea levels rise is uncertain.

It has been assumed that there will be no further development within the erosion risk area.

The accompanying objectives appraisal for Scenario Area 5 – Lang Craig to Whiting Ness is included in Section **G3.5 Lang Craig to Whiting Ness**.

G2.6 Arbroath to West Haven

G2.6.1 Policy Scenarios assessed and assumptions

Table G2.6 Arbroath to West Haven Policy Scenarios assessed and associated assumptions

SMP 2 Management Unit (MU)		SMP 1 policy	SMP 2 Policy Scenarios									Justification
			Policy Scenario A			Policy Scenario B			Policy Scenario C			
			0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs	
6.1 (a)	Victoria Park	Hold the line	Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			Remove current defences and enable the coast to function naturally with minimal interference, allowing sediment to be released back into the system to help restore / stabilise the upper beach, through managed realignment and monitoring.			As Policy Scenario A			<p>Arbroath town is identified as a key policy driver. There a number of residential and economic assets within the town which are potentially at flood risk and tourism is an important function of this area. Economics are likely to justify defences due to the density of residential / tourism / economic areas and infrastructure in the flood risk area.</p> <p>In the long term, holding the existing defences along the Victoria Park frontage will result in complete loss of the beach, which could affect tourism value. Therefore, two options are considered: (A) continue to hold the line through to the long term, and (B) remove current defences and implement a managed realignment policy at Victoria Park to restore a more natural bay shape and upper beach between the natural hard point at Whiting Ness to the north and Arbroath harbour to the south.</p> <p>Another key policy driver is the continued functioning of Arbroath Harbour. Although the maintenance of dock structures is the responsibility of Angus Council and is not covered by flood and defence funding, the defences do perform a coastal defence function and for completeness this unit has been considered by the SMP2.</p> <p>Between Arbroath and West Haven the frontage is a mostly undefended, naturally evolving system. There is contaminated land at Dowrie at risk of flooding / erosion over the next century. It will be important to test localised intervention or maintenance of existing defences in this location, and at East Haven, to assess long term impacts of coastal processes along this frontage. Otherwise, there are minimal assets at risk of flooding / erosion over the next century and therefore there is unlikely to be economic justification to defend the frontage as a whole.</p> <p>The railway line is also identified as a Key Policy Driver and as such, local measures are likely to be required in the near future where the railway is at risk, for example, at Hatton. In addition, opportunities to re-route the railway line further inland on a more sustainable alignment should be investigated.</p>
6.1 (b)	Seagate		Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			As Policy Scenario A			
6.2	Arbroath Harbour	Hold the line	Hold the line through maintenance and upgrading of existing defences – thus assumes ongoing maintenance of harbour structures.			As Policy Scenario A			As Policy Scenario A			
6.3	Inchcape Park to Westway Road	Hold the line	Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			As Policy Scenario A			
6.4 (a)	West Links to East Haven	Selectively Hold the Line: Hold the Line (part) / Limited Intervention (part) / No Active Intervention (part)	Allow the dunes to evolve and retreat naturally, through no active intervention .			As Policy Scenario A			Localised hold the Line at Dowrie and along the railway line at Hatton, through maintenance and upgrading of existing defences, to ensure that the risk of flooding and erosion is managed.			
6.4 (b)	East Haven		Allow the dunes to evolve and retreat naturally, through no active intervention , Monitor risks to East Haven.			As Policy Scenario A			Hold the line through monitoring risks to the village and dune management. Construct new defences to manage the risk of flooding and erosion if risk to the village increases.			
6.4 (c)	East Haven to West Haven		Allow the dunes to evolve and retreat naturally, through no active intervention .			As Policy Scenario A			As Policy Scenario A			

G2.6.2 Appraisal of potential impacts on coastal behaviour and shoreline evolution

Policy scenario A

Short term (up to 20 years)

There is little fresh input of sediment into the system along this frontage. North of Arbroath Harbour, the existing coastal defences have cut off any potential for the reworking of hinterland deposits through erosion. The Seagate and Victoria Park frontage, bounded by Arbroath Harbour to the south and Whiting Ness cliffs to the north, is effectively a self contained unit with minimal links with adjacent frontages.

At Victoria Park, the reflective nature of the existing defences, combined with the wide rock platform and little new sediment input will mean very little material will accumulate in this location. Between Victoria Park and Seagate, the beach may roll back where unconstrained.

The construction of Arbroath Harbour has led to modification of the natural shoreline in this area. Under this policy scenario it is assumed that the dock structures are maintained and remain. However, it should be noted that the structures are not specifically coastal defences, and therefore their future maintenance is dependent upon the long term management strategy for the harbour. With these structures in place, little change in coastal processes is anticipated along the Arbroath shoreline; the harbour structures will fix the shoreline position and therefore there is likely to be little change in shoreline position within the harbour from present. Despite the outer breakwaters providing some shelter, the seawalls along the inner harbour frontage will continue to be subjected to some wave action and increased wave overtopping frequency is likely to occur over time, therefore upgrading of defences may be required if risks increase.

The seawalls along the Inchcape frontage will fix the shoreline position and exacerbate beach lowering of the already low beaches due to their reflective nature, resulting in beach and foreshore erosion. Consequently, increased frequency and magnitude of wave overtopping will occur over time, therefore changes to defences are likely to be required to address this issue.

To the south of Arbroath, the coastline is mostly undefended and, assuming current conditions continue, existing erosion patterns are likely to continue, with the net longshore drift of sediment being to the south. However, shingle movement on the upper beach predominantly occurs during storm conditions. The cobble storm beach at the dune toe will continue to provide some natural protection to the backing dunes; however, a very slow retreat of the beach is likely to continue, as has been observed over the last 30 years.

Under a no active intervention policy, the revetment at Dowrie has a sufficient residual life to remain throughout this period, and therefore there is potential for a slight promontory to form if dune erosion occurs to the north and south of the defence.

Between Corse Hill and West Haven, the intertidal rock platform will continue to provide protection to the sand beach. Longshore transport will tend to be episodic, being limited to periods of higher wave conditions occurring on high tides.

The short local seawall at Hatton, protecting the railway, will deteriorate and fail during this epoch. Following failure of the defence, the railway will be at increasing risk of damage. Under this policy scenario, opportunities to re-route the railway line further inland on a more sustainable alignment should be investigated at the earliest opportunity.

At East and West Haven there are breaks in the shore platform, forming natural harbours. These act as pockets catching sediment being transported south along the coastline.

Coastal flood and erosion risk would need to be monitored at East Haven and adaptation measures, such as relocating paths and car parks, implementing flood warning schemes and evacuation plans, should be put in place to address increased future risk. Flood resistance and resilience approaches within residences, implemented by the home owners, would also be encouraged.

Medium term (20 to 50 years)

Assuming current conditions continue, net southerly sediment transport will continue, and there will be little new input of sediment into the system along this frontage. Rates of change are likely to continue to be relatively slow compared to other more dynamic soft sedimentary sections of the Angus coast, due to the existence of the shingle and cobble storm beach along the majority of the frontage south of Arbroath.

There is potential for increased frequency and magnitude of wave overtopping over time at Victoria Park; however, this will only affect the park and King's Drive, as the majority of assets are located on the higher land behind the park area. Lowering and narrowing of the shingle beach at Seagate in front of defences is likely to continue. It has been assumed that no new beach structures would be built and therefore the beach will be lost over time.

Arbroath Harbour will continue to fix the shoreline position and provide shelter to the inner harbour and flood risk areas. Narrowing of the small shingle beaches within the harbour will occur as inner beaches are squeezed against the hard defences as sea levels rise. As a result, the standard of protection afforded by these defences may reduce and more substantial defences may be required to address the increase in flood risk to the hinterland.

The defences at Inchcape will also continue to fix the shoreline position, south of the harbour, resulting in potential for loss of the intertidal area as sea levels rise. This will put increasing pressure on defences and therefore capital works may be required to maintain / increase the standard of protection in this location.

Between Arbroath and West Haven, assuming present conditions continue, the pattern of general retreat will continue, although this will vary both linearly and temporally along the frontage. The storm beach will continue to provide protection to the backing dune system.

The revetment at Dowrie will deteriorate and fail towards the end of this epoch.

The effect of the rock platform on wave conditions and consequential beach planshape response is highly dependent on long term water level trends. Even very small differences in the elevation of the rock platform can have a noticeable impact on the beach planshape and the patterns of erosion along the frontage. With sea level rise, the influence of the platform may reduce for longer periods of time as it becomes submerged. Consequently, a slight increase in mean water levels may result in greater wave energy reaching the beach which could lead to a greater rate of longshore transport of sand along the sections fronted by the rock platform. In effect this could act to 'smooth out' or reduce lateral variations in beach planshape that have occurred due to variations in the elevation of the rock platform along the coast. This could result in future accretion at East and West Haven.

Coastal flood and erosion risk should continue to be monitored at East Haven and if required adaptation measures, such as those described above, should be put in place to address increased future risk.

Long term (50 to 100 years)

Assuming current conditions continue, at Victoria Park, there is potential for increased frequency and magnitude of wave overtopping over time, with sea level rise. Consequently, higher, more substantial defences may be required to address this issue. Impacts will, however, be restricted to the local park and road

due to the presence of rising land behind. The rock platform fronting the beach may also become submerged during this period. The beach in front of defences at Seagate will eventually be lost as sea levels rise.

Within the harbour and along the Inchcape frontage, narrowing and eventual loss of the fronting beaches is likely due to coastal squeeze against the hard defences as sea levels rise. Overtopping and flood risk will also increase over time, which may result in the need for higher, more substantial defences to address increased flood risk to Arbroath assets.

South of Arbroath, the rock platform fronting the beach may become submerged as sea levels rise. The natural protection afforded by the rock platform to the beach will therefore diminish over time and potentially result in increased retreat of the shoreline over this period; however, erosion rates are still expected to be relatively low. Longshore transport rates may increase and erosion of frontal dunes will feed local beaches and those down drift towards East and West Haven.

Coastal flood and erosion risk would be monitored at East Haven and it would be likely that adaptation measures described above would need to be put in place to address increased future risk.

Policy scenario B

This scenario considers the impact of implementing a managed realignment policy at Victoria Park.

Short term (up to 20 years)

Victoria Park is situated on a raised beach surface. Under this scenario, existing defences at Victoria Park would be removed to enable the coast to function naturally with minimal interference. Following defence removal, reactivation / re-working of hinterland deposits will release sediment stored in the raised beach back into the system in order to potentially feed a new beach at a more set back location and help stabilise the frontage. There is likely to be rapid erosion of the raised beach back to a more natural alignment, following which erosion rates are likely to be relatively low. A new beach would be effectively created, on top of the raised platform; however the material may be different from the thin shingle deposits that are currently seen along the Victoria Park frontage.

As the Victoria Park frontage is bounded by Arbroath Harbour to the south and Whiting Ness cliffs to the north, it is effectively a self contained unit with minimal links with adjacent frontages. Therefore, released sediment is likely to either stay within this unit or be transported offshore by tidal currents and into the general tidal circulation system of Carnoustie Bay.

The shoreline south of Victoria Park, from Arbroath to West Haven is predicted to behave as for Scenario A.

Medium term (20 to 50 years)

Potential erosion of the raised beach at Victoria Park will continue as sea levels rise, albeit at a relatively low rate. This will act to release more sediment onto the fronting beach. Released sediment is likely to either stay within this unit or be transported offshore by tidal currents and into the general tidal circulation system of Carnoustie Bay.

With sea level rise, the influence of the rock platform in providing protection to the beach that rests on it may reduce for periods of time as it becomes submerged.

The shoreline south of Victoria Park, from Arbroath to West Haven is predicted to behave as for Scenario A.

Long term (50 to 100 years)

Erosion of the raised beach at Victoria Park will continue as sea levels rise, albeit at a relatively low rate. Eroded sediment will provide material to the local beach or may be transported offshore. There may be a need

for set back defences to be constructed in the long term if higher land and assets are at risk of erosion. Permanent submergence of fringing rock platforms may occur as sea levels rise. The natural protection afforded by the rock platform to the beach will therefore diminish over time and potentially result in increased retreat of the shoreline over this period; however, erosion rates are still expected to be relatively low.

The shoreline south of Victoria Park, from Arbroath to West Haven is predicted to behave as for Scenario A.

Policy scenario C

This scenario considers the impact of implementing a localised hold the line policy at Dowrie, the railway line at Hatton and at East Haven.

Short term (up to 20 years)

The Arbroath shoreline is predicted to behave as for Scenario A.

Under a selective hold the line policy, risk to the contaminated land at Dowrie and the railway line at Hatton would be monitored. Maintenance of existing defences is likely to be required to maintain standards of protection at Dowrie. This defence will act to fix the shoreline in this location. The cobble beach at the dune toe to the north and south of the defence will continue to provide some natural protection to the backing dunes; however, a very slow retreat of the beach is likely to continue, as has been observed over the last 30 years. There is potential for a slight promontory to form if dune erosion increases to the north and south of the defence.

Between Corse Hill and West Haven, the intertidal rock platform will continue to provide protection to the sand beach. Longshore transport will tend to be episodic, being limited to periods of higher wave conditions occurring on high tides.

Under this policy, railway defences at Hatton will require upgrading in the short term to maintain the standard of protection to the railway line. As the length of defence required is relatively short, there would be minimal impacts on coastal processes in this location. The current alignment of the railway in this location will, however, become increasingly unsustainable over time. Therefore, opportunities to re-route the railway line further inland on a more sustainable alignment should also be investigated.

At East and West Haven there are breaks in the shore platform, forming natural harbours. These act as pockets catching sediment being transported south along the coastline.

Coastal flood and erosion risk to East Haven village would need to be monitored and dune management measures such as dune planting could be undertaken if dune erosion becomes an issue in the future. In addition, adaptation measures, such as relocating paths and car parks, implementing flood warning schemes and evacuation plans, should be put in place to address increased future risk. Flood resistance and resilience approaches within residences, implemented by the home owners, would also be encouraged.

Medium term (20 to 50 years)

The Arbroath shoreline is predicted to behave as for Scenario A.

Assuming present conditions continue, the pattern of general retreat will continue between Arbroath and West Haven, although this will vary both linearly and temporally along the frontage. Where present, the storm beach will continue to provide protection to the backing dune system.

Under a selective hold the line policy, maintenance of existing defences at Dowrie is likely to be required to maintain standards of protection. If dune erosion increases to the north and south of the defence, cut back

may require an extension of the defence to the north and /or south to address risk to the contaminated land. The defence will continue to fix the shoreline and restrict natural erosion of the dunes in this location.

Under this policy, upgraded railway defences at Hatton will be maintained. There is expected to be minimal impacts on coastal processes in this location due to the relatively short length of defence. Opportunities to re-route the railway line further inland on a more sustainable alignment should continue to be investigated.

Where present, between Corse Hill and West Haven, the effect of the rock platform on the wave conditions and hence beach planshape response is highly dependent on long term water level trends. Even very small differences in the elevation of the rock platform can have a noticeable impact on the beach planshape and the patterns of erosion along the frontage. With sea level rise, the influence of the platform may reduce for longer periods of time as it becomes submerged. Consequently, a slight increase in mean water levels may result in greater wave energy reaching the beach which could lead to a greater rate of longshore transport of sand along the sections fronted by the rock platform. In effect this could act to 'smooth out' or reduce lateral variations in beach planshape that have occurred due to variations in the elevation of the rock platform along the coast. This could result in future accretion at East and West Haven.

Coastal flood and erosion risk to East Haven village would continue to be monitored. Dune management measures, as mentioned above, may help encourage accretion in this location. However, if dune erosion increases in front of properties to the south of the village, construction of a hard defence in this location to reduce risk to properties, would act to fix the shoreline position in this location. As sea levels rise, the influence of the fronting rock platform will reduce and may result in greater wave energy reaching the beach. Consequently, increased overtopping may result and beach levels may drop in front of defences in this location.

Long term (50 to 100 years)

The Arbroath shoreline is predicted to behave as for Scenario A.

South of Arbroath, the rock platform fronting the beach may become submerged as sea levels rise. The natural protection afforded by the rock platform to the beach will therefore diminish over time and potentially result in increased retreat of the shoreline over this period; however, erosion rates are still expected to be relatively low. Longshore transport rates may increase and erosion of frontal dunes will feed local beaches and those down drift towards East and West Haven.

Under a selective hold the line policy, the risks to contaminated land at Dowrie and the railway at Hatton would be monitored. If erosion risk increases during this period, further maintenance and upgrading of defences may be required. Defences will continue to fix the shoreline position and consequently a more pronounced section of coast will form at Dowrie. Assuming the railway remains in its current position, overtopping of defences may increase flood risk to the railway as sea levels rise.

If defences are constructed under a selective hold the line policy at East Haven, beach levels may continue to drop in front of defences and overtopping will increase as sea levels rise.

Key assumptions/ uncertainties

Under a managed realignment policy the erosion rate of the raised beach at Victoria Park is uncertain.

There are limited details on the level of the rock platforms and therefore the risk of them becoming permanently submerged as sea levels rise is uncertain.

It has been assumed that Arbroath Harbour structures will remain; however, harbour structures are not coastal defences and therefore their future role and integrity will be dependent upon future harbour operations.

It has also been assumed in developing policies that the entire railway system will be maintained and will remain a key policy driver over the next century; however, this assessment recognises that opportunities to re-locate the railway to a more sustainable alignment should be actively sought.

The dunes between West Links and West Haven are assumed to be fairly resilient. Current patterns of erosion and accretion will continue. Dunes will however, be vulnerable to any change in frontal dune stability, e.g. due to human pressure and the system would be vulnerable to any significant changes in the wind-wave climate - but there are high levels of uncertainty regarding this parameter.

It has been assumed that there will be no further development within the coastal flood / erosion risk area.

The accompanying objectives appraisal for Scenario Area 6 – Arbroath to East Haven is included in Section **G3.6 Arbroath to West Haven**

G2.7 Carnoustie

G2.7.1 Policy Scenarios assessed and assumptions

Table G2.7 Carnoustie Policy Scenarios assessed and associated assumptions

SMP 2 Management Unit (MU)	SMP 1 policy	SMP 2 Policy Scenarios						Justification	
		Policy Scenario A			Policy Scenario B				
		0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs		
7.1	West Haven to Carnoustie Station	Selectively Hold the Line: Limited Intervention / Hold the Line	Hold the line through maintenance of existing defences and limited intervention, to ensure that the risk of flooding and erosion is managed.			-	-	-	The Carnoustie frontage is almost completely defended; however, defences in the north of the frontage, around West Haven are buried at present. Where defences are currently buried, a future hold the line policy may only mean limited intervention is required for reducing risk to properties.
7.2	Carnoustie Station to Barry Burn	Hold the line	Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			-	-	-	<p>The town of Carnoustie and its golf course is a key tourist centre along this stretch of shoreline. A key driver is therefore to continue to reduce the risk of flooding and coastal erosion to residential, tourism and amenity areas (including the golf course) as well as the railway.</p> <p>Economics are likely to justify a continued defence in this location due to the density of residential / tourism / economic areas and infrastructure in the flood / erosion risk zone.</p> <p>Future policy choice along the Barry Sands East unit will also have an impact on Carnoustie Bay as a whole, with regards to future sediment supply to the Carnoustie frontage.</p>

G2.7.2 Appraisal of potential impacts on coastal behaviour and shoreline evolution

Policy scenario A

Short term (up to 20 years)

The patterns and rates of erosion and accretion within Carnoustie Bay are intrinsically linked to the movements of the Tay Estuary channel and the form of the Gaa Spit (at the southern tip of the Ness), and the effect that these changes have on tidal flows and wave conditions. This process is one of a continuous feedback loop, with the changes in tidal flows and wave conditions themselves promoting alterations in the position of the Tay Estuary channel and Gaa Sands. How these processes act and interact with each other is extremely complex and is poorly understood at present. The impact of the rock revetments along this frontage and at Barry Sands East on morphological processes within Carnoustie Bay is also poorly understood.

Within Carnoustie Bay, tidal currents play an important role in the movements of sediment within the Bay and along the Carnoustie coastline. The existence / location of a drift divide along the northern section of the rock revetment at Barry Sands East has been postulated, where sediment moves into Carnoustie Bay to the north and towards Gaa Sands and Gaa Spit to the south; however, this is not well understood. In the future sediment supply to this frontage from the eastern flank of Buddon Ness will be affected by policy at Barry Sands East.

The intertidal rock platform along the eastern part of the unit will continue to provide natural protection to this stable part of the frontage. Although the frontal dune system between West Haven and Carnoustie railway station is likely to remain stable, it will be susceptible to storm damage. Storm damage may result in a reduced standard of protection; however, it is expected that the frontage would recover again over time.

Between the railway station and Barry Burn, there are substantial rock revetments along the frontage which act to reduce flood risk to the hinterland; under current conditions, falling beach levels are likely to occur due to reflection from the defence and the potential for a reduction in sediment transported to the Carnoustie frontage from Barry Sands East.

In this location, the rock revetment may need to be upgraded to address increasing overtopping issues over time.

Medium term (20 to 50 years)

The patterns and rates of erosion and accretion within Carnoustie Bay are intrinsically linked to the movements of the Tay Estuary channel and the form of the Gaa Spit (at the southern tip of the Ness), and the effect that these changes have on tidal flows and wave conditions. Within Carnoustie Bay, tidal currents play an important role in the movements of sediment within the Bay and along the Carnoustie coastline. In the future sediment supply to this frontage from the eastern flank of Buddon Ness will be affected by policy at Barry Sands East.

The intertidal rock platform between West Haven and Carnoustie Station is expected to continue to provide some natural protection to the frontage; however, this influence will reduce over time with sea level rise. Assuming present conditions continue, the dunes are predicted to remain relatively stable. However, if frontal erosion of the dunes becomes an issue, dune management measures, such as planting or dune fencing could be implemented to help slow the erosion, or additional defences (e.g. rock revetment) may be required.

The inter-tidal beach will continue to narrow and lower seaward of the rock revetment to the west between Carnoustie Station and the Barry Burn due to reflection from the defence and as sea levels rise. More substantial defences may be required to address increasing overtopping issues over time.

Long term (50 to 100 years)

The patterns and rates of erosion and accretion within Carnoustie Bay will continue to be intrinsically linked to the movements of the Tay Estuary channel and the form of the Gaa Spit (at the southern tip of the Ness), and the effect that these changes have on tidal flows and wave conditions. These complex interactions makes attempting to predict what will happen in the future extremely difficult. Therefore, assuming that current conditions continue into the future, present patterns of erosion and accretion are expected to continue.

Between West Haven and Carnoustie Station, the rock platform fronting the beach may become submerged as sea levels rise. The natural protection afforded by the rock platform to the beach will therefore diminish over time. Although the dune system is assumed to remain fairly resilient if current conditions continue, there is potential for increased frontal erosion as sea levels rise. Consequently, more substantial works in the form of an extension of the rock revetment to the west may be required along this frontage to protect properties at risk.

Between Carnoustie Station and the Barry Burn, the inter-tidal beach will continue to narrow and lower seaward of the defence structures as sea levels rise. As the sea level rises, wave action will move higher onto the beach resulting in erosion of the beach and an increased risk of overtopping of defences. More substantial defences may be required to address overtopping issues over this epoch.

Key assumptions/ uncertainties

Dunes will be vulnerable to any change in frontal dune stability, e.g. due to human pressure and the system would be vulnerable to any significant changes in the wind-wave climate - but there is a high level of uncertainty regarding this parameter.

The position of the Gaa Spit, wave climate and tidal processes will continue to have considerable influence on erosion and accretion patterns within Carnoustie Bay. Consequently, future rates of dune erosion / accretion along the Carnoustie frontage remain uncertain.

Sediment supply within Carnoustie Bay is also uncertain. In the future, sediment supply to this frontage from the eastern flank of Buddon Ness will be affected by policy at Barry Sands East.

There are limited details on the level of the rock platforms and therefore the risk of them becoming permanently submerged as sea levels rise is uncertain.

The accompanying objectives appraisal for Scenario Area 3 – Carnoustie is included in Section **G3.7 Carnoustie**

G2.8 Buddon Ness

G2.8.1 Policy Scenarios assessed and assumptions

Table G2.8 Buddon Ness Policy Scenarios assessed and associated assumptions

SMP 2 Management Unit (MU)		SMP 1 policy	SMP 2 Policy Scenarios						Justification	
			Policy Scenario A			Policy Scenario B				
			0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs		
8.1	Barry Sands East	Hold the line	Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			Hold the line through maintaining the existing defences until they reach the end of their effective life.			Remove failing defences and enable the dune system to function naturally with minimal interference through managed realignment and monitoring.	Buddon Ness is an extensive dune system primarily used by the MoD as a training area and firing range. The dunes are nationally designated and the intertidal areas are internationally designated. The MoD land is identified as a key policy driver, where continued protection is required. The internationally designated intertidal areas along the whole of this frontage (Firth of Tay and Eden Estuary SAC / SPA / Ramsar) are also identified as Key Policy Drivers, as loss of designated intertidal habitat will mean that compensation habitat is likely to be required to provide replacement habitat for Ramsar/SPA birds and other notified Ramsar interests. If the MoD withdraws from Buddon Ness in the future, there would be an opportunity for managed erosion of the dunes to support the conservation of the SSSI. Future policy choice along the Barry Sands East frontage will also have an impact on Carnoustie Bay as a whole, with regards to future sediment supply to the adjacent Carnoustie frontage.
8.2	Barry Buddon & Barry Sands West	No active intervention	Allow the dune system to evolve and retreat naturally, through no active intervention .			As Policy Scenario A				

G2.8.2 Appraisal of potential impacts on coastal behaviour and shoreline evolution

Policy scenario A

Short term (up to 20 years)

The patterns and rates of erosion and accretion along the eastern flank of Buddon Ness and within Carnoustie Bay are intrinsically linked to the movements of the Tay Estuary channel and the form of the Gaa Spit (at the southern tip of the Ness), and the effect that these changes have on tidal flows and wave conditions. This process is one of a continuous feedback loop, with the changes in tidal flows and wave conditions themselves, promoting alterations in the position of the Tay Estuary channel and Gaa Sands. How these processes act and interact with each other is extremely complex and is poorly understood at present.

The rock armour revetment extending for approximately 2.6km along the Barry Sands East frontage of Buddon Ness will continue to effectively restrict the naturally highly dynamic movement of the beach and backing dune system and restrict natural sediment exchange between the beach and dunes. The impact of the rock revetment on morphological processes within Carnoustie Bay are poorly understood; however, it is fair to assume that current problems of seabed lowering in front of this defence is likely to continue as a result of tidal currents induced by the changing orientation of the Tay Estuary Channel and changes to the Gaa Spit. Overtopping of the defence and the resulting scour of the backing dunes may undermine the revetment over time. Under a hold the line policy defences may therefore require upgrading to address this problem. The continued defence of this frontage may have an impact on sediment supply to and erosion of the Monifieth frontage; however, the potential links between these frontages are poorly understood at present.

The existence / location of a drift divide along the northern section of the rock revetment at Barry Sands East has been postulated, where sediment moves into Carnoustie Bay to the north and towards Gaa Sands and Gaa Spit to the south; however this is not well understood. The net movement of sediment to the south is expected to continue along the eastern flank of the Ness. Consequently, continued cut back of the dunes is expected to continue to the south of the revetment and accretion is expected to continue at Gaa sands to the south of Buddon Ness.

The highly dynamic undefended Buddon Ness frontages to the south and west will continue to evolve naturally. Along the western flank of Buddon Ness, longshore transport is dominated by wave action entering the Tay Estuary from the North Sea, with resultant net sediment transport to the north-west towards Monifieth. However, patterns of erosion and accretion along the western frontage suggest a more complex situation, being linked to the movements of the sand banks at the mouth of the Tay and the position and depth of a nearshore channel that runs parallel to the coastline in this location. Due to the sensitivity of the coastline to changes in the configuration of sand banks and the channel, it is difficult to identify any clear erosion / accretion trend along this frontage. Assuming current conditions exist in this period, current erosion and accretion patterns along the Barry Sands West frontage are likely to continue with the growth of the spit deflecting the Buddon Burn outlet towards the west.

Medium term (20 to 50 years)

The patterns and rates of erosion and accretion along the eastern flank of Buddon Ness and within Carnoustie Bay are intrinsically linked to the movements of the Tay Estuary channel and the form of the Gaa Spit (at the southern tip of the Ness), and the effect that these changes have on tidal flows and wave conditions.

Assuming current conditions continue, seabed lowering caused by tidal currents will be exacerbated by coastal squeeze of intertidal areas against the defence along the Barry Sands East frontage as sea levels rise. Further defence crest protection may be required to reduce erosion caused by overtopping. With continued

alongshore transport of material south along the eastern flank of the Ness, downdrift cut back of dunes to the south of the defence is expected to continue and accretion at Gaa Sands.

The highly dynamic Buddon Ness dune system will continue to evolve naturally to the south and west. Due to the sensitivity of the coastline to changes in the configuration of sand banks at the mouth of the Tay and the channel that runs parallel to the coast in this location, it is difficult to identify any clear erosion / accretion trend along this frontage. Therefore, assuming current conditions continue, present patterns of erosion and accretion are expected to continue, with net sediment movement towards Monifieth in the west.

Long term (50 to 100 years)

The patterns and rates of erosion and accretion along the eastern flank of Buddon Ness and within Carnoustie Bay will continue to be intrinsically linked to the movements of the Tay Estuary channel and the form of the Gaa Spit (at the southern tip of the Ness), and the effect that these changes have on tidal flows and wave conditions. The patterns of erosion and accretion along the western flank of Buddon Ness are linked to the movements of the sand banks at the mouth of the Tay and the position and depth of a nearshore channel that runs parallel to the coastline in this location. These complex interactions makes attempting to predict what will happen in the future extremely difficult. Therefore, assuming that current conditions continue into the future, present patterns of erosion and accretion are expected to continue.

Under current conditions, seabed lowering caused by tidal currents is expected to continue and there is potential for loss of intertidal areas due to coastal squeeze against the Barry Sands East defences as sea levels rise. Increased overtopping with sea level rise and continued outflanking and erosion of the dunes to the south of the defence may result in the need to extend the defences further south if the MoD operations and assets are at risk. Any extension of defences south would, however, act to move the erosion issue further south and cut off more sediment from the system. Under current conditions and assuming a continued sediment supply within Carnoustie Bay, accretion at Gaa Sands is expected to continue as material is transported south along the eastern flank of the Ness.

Erosion and accretion patterns are likely to continue to fluctuate along the highly dynamic western flank of the Ness, dependant on sand bank and channel configurations along the frontage and at the mouth of the Tay.

Policy scenario B

This scenario considers a change in policy at Barry Sands East. It considers the impact of implementing a hold the line policy at this location, in the short term, followed by a policy of managed realignment in the medium and long term. Under the policy of managed realignment, it is intended that once the existing defences reach the end of their effective life they would no longer be maintained, and may be removed, and then natural dune evolution would be allowed to resume. Under this policy, localised dune management could be undertaken, such as dune planting and low-level sand trapping structures, but these should not be detrimental to the overall long term evolution or functioning of the dunes.

Short term (up to 20 years)

The shoreline is predicted to behave as for Scenario A, but the existing defences will only be maintained and not improved and will therefore start to fail over time.

Medium term (20 to 50 years)

Under a managed realignment policy it has been assumed that the failing defences at Barry Sands East would be removed, to address potential safety issues as the defences fail and to restore the natural link between the dunes and the beach. Once defences have been removed, there is potential for rapid erosion of the links area under natural processes, back to a more natural alignment. It is fair to assume that current problems of seabed

lowering along this frontage is likely to continue as a result of tidal currents induced by the changing orientation of the Tay Estuary Channel and changes to the Gaa Spit; however, activation of dune erosion will provide new sediment to the local beach system. Some of this material is likely to be moved northwards into Carnoustie Bay, providing additional sediment to feed local Carnoustie beaches, but the net movement of material is likely to be south, towards Gaa Sands and Gaa Spit. Continued accretion of Gaa Sands is therefore expected under this scenario. Erosion patterns along the Barry Sands East frontage will be influenced by the location of the drift divide as well as wave and tidal conditions along this frontage, as mentioned previously.

The western Buddon Ness shoreline is predicted to behave as for Scenario A.

Long term (50 to 100 years)

Erosion and accretion patterns along the eastern Buddon Ness frontage will be linked to the location of the drift divide, movements of the Tay Estuary channel and the form of the Gaa Spit (at the southern tip of the Ness), and the effect that these changes have on tidal flows and wave conditions. Under current conditions, seabed lowering caused by tidal currents is expected to continue; however, dune erosion will continue to provide a supply of sediment to the local beach system. Some of this material is likely to be moved northwards into Carnoustie Bay, providing additional sediment to feed local Carnoustie beaches, but the net movement of material is likely to be south, towards Gaa Sands and Gaa Spit. Continued accretion of Gaa Sands is therefore expected.

The western Buddon Ness shoreline is predicted to behave as for Scenario A.

Key assumptions/ uncertainties

The location / existence of a drift divide along the Barry Sands East frontage, and therefore future erosion patterns along this frontage under a managed realignment scenario are uncertain.

The position of the Gaa Spit, wave climate and tidal processes will continue to have considerable influence on erosion and accretion patterns along the eastern Buddon Ness frontage. Changes to the Tay Channel and offshore sand banks and bars will continue to influence the wave climate and future erosion and accretion patterns along the western Buddon Ness frontage. Consequently, future rates of dune erosion / accretion on Buddon Ness remain uncertain.

Sediment supply within Carnoustie Bay is also uncertain.

Scenario A assumes that the MoD requires continued erosion protection at Barry Sands East into the long term.

The accompanying objectives appraisal for Scenario Area 8 – Buddon Ness is included in Section **G3.8 Buddon Ness**

G2.9 Monifieth to Broughty Ferry

G2.9.1 Policy Scenarios assessed and assumptions

Table G2.9 Monifieth to Broughty Ferry Policy Scenarios assessed and associated assumptions

SMP 2 Management Unit (MU)	SMP 1 policy	SMP 2 Policy Scenarios						Justification	
		Policy Scenario A			Policy Scenario B				
		0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs		
9.1	MoD Boundary to west Tayview Caravan Park	Hold the line	Hold the line through maintenance of existing defences and limited intervention, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			<p>The towns of Monifieth and Broughty Ferry are key tourist and commercial centres along this stretch of shoreline. A key driver is therefore to continue to reduce the risk of flooding and coastal erosion to these residential and amenity areas. There is also a potential contamination issue at the former disposal site at Monifieth playing fields.</p> <p>Economics are likely to justify a continued defence due to the density of tourism areas, contaminated land and infrastructure in the flood / erosion risk area. To the east of Monifieth, and to the west, at Broughty Ferry, the frontages are currently accreting, therefore, a future HTL policy in this location may only mean limited intervention is required to reduce risk to assets.</p>
9.2	Monifieth West	Hold the line	Hold the line through maintenance and upgrading the existing defences and restoring / stabilising the upper beach, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			
9.3	Barnhill to the Esplanade	Hold the line	Hold the line through maintenance and upgrading the existing defences, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			
9.4	Broughty Ferry East	Hold the line	Hold the line through limited intervention and dune management, to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			
9.5	Broughty Ferry	Hold the line	Hold the line through maintenance of existing defences, limited intervention and dune management to ensure that the risk of flooding and erosion is managed.			As Policy Scenario A			

G2.9.2 Appraisal of potential impacts on coastal behaviour and shoreline evolution

Policy scenario A

Short term (up to 20 years)

The mechanisms that move sand along the beach and within Monifieth Bay, and the subsequent patterns of erosion and accretion, are a complex interaction of wave and tidal processes that are, as yet, poorly understood. Erosion and accretion patterns along the Monifieth and Broughty Ferry frontages are, however, highly dependent on the movement and depth of channels and the configuration of bank systems at the mouth of the Tay Estuary and over the lower foreshore within Monifieth Bay. Due to the sensitivity of the coastline to these changes it is difficult to identify any clear erosion / accretion trend. Longshore transport is dominated by wave action entering the Tay from the North Sea with sediment tending to be moved to the north-west along the western flank of Buddon Ness to the west from Monifieth to Broughty Ferry. The potential for a sediment supply to this frontage from Carnoustie Bay and the eastern flank of Buddon Ness will be affected by policy at Barry Sands East.

At Monifieth, if present conditions continue, accretion is likely along the eastern part of the frontage between the Riverside Caravan Park and the MoD boundary, whilst along the western part of the frontage towards Milton Mill, erosional trends are likely to continue. Defences may need to be upgraded to address overtopping issues over time. The low beach will continue to become more depleted unless there is a change in how the frontage is managed. Measures, such as the use of rock fish tail groynes combined with beach recharge campaigns could help maintain a beach in this location; however, sediment transported west would be interrupted by these structures and the knock on effect would be increased erosion further downdrift at Broughty Ferry. Backing dunes should remain relatively stable, whilst protected by the existing timber bulkhead. However, the bulkhead will act as a barrier between the beach and dune system, inhibiting natural processes and interaction between the two systems.

Tidal currents, acting around the headland at Broughty Castle will recycle beach sediments back along the lower intertidal beach onto Lady Bank. Some of this sediment will be moved back on to the beaches by wave action but some will also be lost from the frontage due to complex residual current patterns within the Tay Estuary.

West of the Dighty Water, under current conditions, continued erosion is predicted. This may be exacerbated if beach retaining structures are constructed as part of a hold the line policy at Monifieth to the east, as described above. Implementation of beach retaining structures along this frontage, such as rock groynes, may help to improve beach levels but may also impact on down drift frontages at Broughty Ferry. Assuming current conditions continue, the stability of beaches and dunes to the west of this frontage towards Broughty Castle is likely to continue, as long as the sediment supply from the east is maintained.

Medium term (20 to 50 years)

As explained above, future evolution of the Monifieth and Broughty Ferry frontage will be highly dependent on the configuration of channels and bank systems within Monifieth Bay and at the mouth of the Tay estuary. Longshore transport tends to move from east to west from Buddon Ness and Monifieth to Broughty Ferry. The potential for a sediment supply to this frontage from Carnoustie Bay and the eastern flank of Buddon Ness will be affected by policy at Barry Sands East.

If present conditions continue, at Monifieth, there is predicted to be little net change along the eastern part of the frontage between Riverside Caravan Park and the MoD boundary. In the west, and central sections, the trend of beach lowering is likely to continue with sea level rise due to coastal squeeze against defences. If long term erosion is evident and there is a requirement to retain a beach at this location, beach retaining structures

and dune management measures may be required. Groynes will need to be replaced or recharge undertaken to help maintain the beaches in these locations. The beach is already depleted and will continue to be lost if nothing is done.

At Broughty Ferry, additional beach retaining structures, as mentioned above, may help maintain a beach in the east of the frontage; however, beach lowering may increase as sea levels rise. Along the central frontage, if sea level rise becomes an issue, frontal dune erosion may become more frequent and new defences, including extension of the present rock revetment, may be required to reduce erosion. Beaches in front of defences may narrow due to coastal squeeze as sea levels rise. If current conditions continue the stability of the dunes and beach at Broughty Castle is expected; however, the continued sediment supply to this frontage will depend on works to the east. Stability of this frontage would be affected if larger sediment trapping structures were implemented at Monifieth. If dune erosion becomes an issue, dune management measures would help maintain the integrity and function of the dunes as a natural flood defence.

Long term (50 to 100 years)

As noted above, the configuration of channels and banks within Monifieth Bay and at the mouth of the Tay Estuary will be intrinsically linked to erosion and accretion patterns along this frontage. Longshore sediment transport along this frontage is from east to west. Rates of transport may however, be affected by management options implemented at Monifieth and policy at Barry Sands East.

Assuming a continuation of present conditions, at Monifieth, there is potential for beach lowering and narrowing along the whole frontage as sea levels rise, with long-term intertidal loss to the east and west of the area. In the east of the frontage, if the channel moves landward, present trends may reverse. In this case, additional defences may be required to manage the erosion risk to the landfill site, infrastructure and recreation assets. To the west and mid frontage, further beach recharge campaigns or groynes may help retain a beach where coastal squeeze is an issue in front of defences.

At Broughty Ferry, the pattern of erosion in the east and accretion in the west is likely to continue, assuming current conditions continue. However, the existence of a beach into the long term will depend on options implemented to hold the line at Monifieth. As sea levels rise, frontal dune erosion may increase, and therefore dune management measures may be required to maintain the dunes as an integral part of the flood defence.

Key assumptions/ uncertainties

The mechanisms that move sand along the beach and within Monifieth Bay, and the subsequent patterns of erosion and accretion are a complex interaction of wave and tidal processes that are, as yet, poorly understood.

Erosion and accretion patterns along the Monifieth and Broughty Ferry frontages are intrinsically linked to the movement and depth of channels and the configuration of bank systems at the mouth of the Tay Estuary and over the lower foreshore within Monifieth Bay.

The accompanying objectives appraisal for Scenario Area 9 – Monifieth to Broughty Ferry is included in Section **G3.9 Monifieth to Broughty Ferry**

G3 Objectives Appraisal

The second stage was to appraise the achievement of objectives using the information from the Shoreline Interaction and Response Assessments. Using this information, the impact of the alternative policy scenarios on the defined coastal features and assets has been appraised. Rather than simply stating whether a feature is lost or not, consideration has been given to how a feature is affected and any opportunities that may arise, for example alternative land use or improved access. Changes to these impacts are then considered when looking at the various iterations to the policy scenarios.

Each scenario/policy has been appraised according to the extent to which each of the defined objectives (**Appendix E**) for individual locations is achieved. The policy scenario approach allows us to consider the effects of different combinations of policy options along larger sections of the coast rather than the immediate shoreline or individual locations in isolation. In this way the appropriateness of each option tested can only be determined once considered in conjunction with proposed policies for adjacent locations. This approach also ensures that we fully consider sediment interactions and interdependencies between frontages.

The objectives appraisal has been carried out with a clear knowledge of the policy assumptions and an understanding of what each policy scenario would involve on the ground, e.g. would holding the line in a particular location involve maintaining the current defences, constructing a new sea wall or recharging with beach material, etc. The risk of future erosion or coastal flooding to features under each policy scenario as well as under a 'no active intervention' scenario is described in the following Objectives Tables in **Sections G3.1 to G3.8**. This approach enables a comparison of how each feature will be affected under a no active intervention policy and under each of the individual policy scenarios considered.

From this initial appraisal of policy scenarios, it has been possible to determine whether the previously identified objectives have been met, with a focus on how and why objectives are (or are not) met, rather than simply attempting to add up numbers of objectives achieved. Within this SMP2 weighting or ranking of objectives has not been attempted, as previous experience on SMP2s has proven this technique to be biased towards certain policy drivers and often too subjective. Instead the focus has been on a more qualitative and flexible means of developing and appraising sustainable policy options against technical, economic, environmental and social factors. This method has been found to be more appropriate when considering intangibles and areas where a single policy may have both positive and negative impacts.

This approach has also allowed Client Steering Group (CSG) views, provided via a number of meetings, to be considered and included within both the development of the issues and objectives table, and the subsequent policy appraisal.

The outcome of these appraisal assessments has fed directly into the identification of draft consultation policies.

G3.1 Montrose

Table G3.1 Montrose alternative policy scenarios to test

SMP 2 Policy Scenario Area 1: Montrose						
SMP 2 Management Units	Policies to test – Scenario A			Policies to test – Scenario B		
	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs
MU 1/1 Montrose Bay (Milton Ness to Montrose Links)	NAI	NAI	NAI	As Policy Scenario A		
MU 1/2 Montrose Golf Links	MR	MR	MR	As Policy Scenario A		
MU 1/3 (a) Splash (The Faulds)	HTL	HTL	HTL	MR	MR	MR
MU 1/3 (b) South Links Holiday Park	HTL	HTL	HTL	MR	MR	MR
MU 1/4 GlaxoSmithKline	HTL	HTL	HTL	As Policy Scenario A		

Key: hold the line (HTL); managed realignment (MR); no active intervention (NAI)

Table G3.2 Montrose alternative policy scenarios objective appraisal

SMP 2 Policy Scenario Area 1: Montrose					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Population and human health					
Small settlement at Kinnaber	<ul style="list-style-type: none"> Isolated residential properties 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans.	<p>Short term: Potential flood risk to isolated properties alongside the River North Esk channel.</p> <p>Medium term: Increased flood risk to isolated properties alongside the River North Esk channel.</p> <p>Long term: Increased frequency of flood risk to isolated properties alongside the River North Esk channel.</p>	<p>Short term: Potential flood risk to isolated properties alongside the River North Esk channel.</p> <p>Medium term: Increased flood risk to isolated properties alongside the River North Esk channel.</p> <p>Long term: Increased frequency of flood risk to isolated properties alongside the River North Esk channel.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Montrose town, residential and industry	<ul style="list-style-type: none"> Montrose Port provides import and export services for various agricultural and oil related businesses located within the area. Approximately 40% of the annual port traffic is oil related 	<p>To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans.</p> <p>To minimise the impact of policies on marine operations and activities</p>	<p>Short term: Defences remain in the short term providing flood protection to Montrose town.</p> <p>Medium term: Failure and subsequent breach of defences would result in a high risk of large scale flooding of the low-lying areas of Montrose town, including Montrose Port, residential assets and industry.</p> <p>Long term: There will be an increased risk of more frequent flooding to Montrose town and Port.</p>	<p>Short term: Continued protection of town and port from flooding</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Potential risk of flooding to some low-lying areas in Montrose Town between GlaxoSmithKline and the golf course, including a car park and some industrial buildings. Could be mitigated with localised defence measures. The port would continue to be protected.</p> <p>Medium term: Increased risk of flooding to some areas of Montrose Town between GlaxoSmithKline and the golf course, including a car park and some industrial buildings. The port would continue to be protected.</p> <p>Long term: Increased frequency of flood risk to some areas of Montrose Town, including a car park and some</p>

SMP 2 Policy Scenario Area 1: Montrose					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
					industrial buildings. The port would continue to be protected.
GlaxoSmithKline	<ul style="list-style-type: none"> Bounded to the south by the River South Esk, to the east by Montrose beach and to the north by a caravan park. Comprises over 160 buildings The site employs approximately 720 staff, and is therefore, the major local employer in Montrose. 	To minimise coastal flood and erosion risk to industry, commercial and economic activities.	<p>Short term: The beach is expected to continue to afford erosion protection to the Glaxo site.</p> <p>Medium term: The beach is expected to continue to afford erosion protection to the Glaxo site. However, parts of the Glaxo site will be at risk of flooding from the west.</p> <p>Long term: The beach is expected to continue to afford erosion protection to the Glaxo site; however if the beach erodes significantly the site will be at risk of erosion. There will be an increased risk of more frequent flooding to western parts of the Glaxo site.</p>	<p>Short term: Continued protection of GlaxoSmithKline from flooding. The frontage is likely to remain stable as the recharged beach, dune planting and groyne system helps retain sediment in this location.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Bathing and recreational beach	<ul style="list-style-type: none"> Montrose beach achieved Blue Flag status in 2004 	To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities	<p>Short term: Amenity value of the beach will reduce as the reflective nature of the defences at Splash, and coastal squeeze against these defences will result in narrowing of Montrose Beach.</p> <p>Medium term: Erosion of dunes following the failure of defences at Splash will release stored sediment to Montrose Beach. Access to the beach will however, be compromised.</p> <p>Long term: Potentially no safe access to Montrose Beach due to failure of defences and erosion of dunes.</p>	<p>Short term: The amenity value of the beach will be maintained, if the upper beach is recharged as part of the scheme.</p> <p>Medium term: As above</p> <p>Long term: As above, but the sustainability of using dredged material for recharge may become an issue.</p>	<p>Short term: The gradual roll-back of the dunes may result in some changes to the amenity value of the beach, particularly following defence removal.</p> <p>Medium term: The natural shoreline adjustment is likely to release sediment into the system, which will continue to feed the beach and reinstate the dunes. The roll-back of the dunes and dune management may increase the extent of exposed beach at high tide and there will be an overall retention of the amenity value of the beach.</p> <p>Long term: As above</p>
Recreational facilities	<ul style="list-style-type: none"> Two 18-hole golf courses in north of unit Existing beach pavilion area refurbished in 1998 Splash area with existing facilities upgraded to provide children's play area, paddling pool, refurbished café, small amusement arcade and additional car parking. Amusements, pitch & putt at East links Windsurfing at Montrose bay Coastal walks along shoreline and Charleton and Kinnaber links 	To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities	<p>Short term: Continued loss of parts of the golf course on the eroding dunes. Defences will continue to protect the Splash recreational area. Minimal flood risk to coastal walks.</p> <p>Medium term: Continued loss of parts of the golf course on the eroding dunes. Following defence failure, recreational facilities at Splash will be at risk of erosion. Flood risk to coastal walks will increase.</p> <p>Long term: Continued loss of parts of the golf course on the eroding dunes. Splash recreational facilities will be lost. There will be an increased risk of more frequent flooding to coastal walks.</p>	<p>Short term: The set-back of some northern parts of the golf course will be required due to the continued erosion of the dunes. However, most other recreational assets including the Splash area will continue to be protected.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: The set-back of some northern parts of the golf course will be required due to the continued erosion of the dunes. There is accommodation space available for assets at the Splash recreation area to be relocated further landward.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
South Links Holiday Park	<ul style="list-style-type: none"> Privately run caravan park catering for summer visitors. 	To minimise coastal flooding and erosion risk to key recreation and tourism assets	Short term: Defences will remain providing protection to the caravan park.	Short term: Continued protection of the caravan park.	Short term: Potential risk of erosion to the caravan park, though dune management will provide some

SMP 2 Policy Scenario Area 1: Montrose					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
	<ul style="list-style-type: none"> Formal access to the beach 	and activities	<p>Medium term: Following defence failure, erosion and flood risk to the caravan park.</p> <p>Long term: There will be an increased risk of more frequent flooding to, and erosion of the caravan park.</p>	<p>Medium term: As above</p> <p>Long term: As above</p>	<p>protection in the short-term.</p> <p>Medium term: Increasing risk of erosion to the seaward edge of the caravan park. Parts of the park will need to be relocated over time.</p> <p>Long term: As above.</p>
Historic landfill site at Montrose	<ul style="list-style-type: none"> The historic landfill is located alongside the railway line south of the Tayock River. 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans.	<p>Short term: Defences remain in the short term providing flood / erosion protection to the historic landfill area.</p> <p>Medium term: Failure of defences will result in erosion / flood risk to the site and potential release of contaminants.</p> <p>Long term: Increased flood / erosion risk to the historic landfill site and increased risk of release of contaminants.</p>	<p>Short term: Continued flood and erosion protection to the historic landfill area.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Material Assets and Infrastructure					
Navigation route to Montrose Harbour	<ul style="list-style-type: none"> Need to maintain safe navigation and access to the harbour 	To minimise the impact of policies on marine operations and activities	<p>Short term: Assuming dredging does not take place, safe navigation and access to Montrose Harbour will be compromised.</p> <p>Medium term: As short term.</p> <p>Long term: As short term.</p>	<p>Short term: Continued protection of harbour infrastructure. Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Minor access roads and car parks	<ul style="list-style-type: none"> Provides access to settlements and some other locations along the coastline 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Defences remain in the short term providing erosion protection to the Splash car park. Potential flood risk to minor access roads alongside the River North Esk channel and the access road to the car park at Nether Warburton.</p> <p>Medium term: Following defence failure, the car park at Splash and access road will be lost. Increased flood risk to minor access roads alongside the River North Esk channel and the access road to the car park at Nether Warburton.</p> <p>Long term: Splash car park and access road will be lost. Increased frequency of flood risk to minor access roads alongside the River North Esk channel and the access road to the car park at Nether Warburton.</p>	<p>Short term: Continued protection to the Splash car park and minor access roads.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Traill Road and Splash car park will need to be relocated further inland as part of the managed realignment scheme.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Sewage outfall: St Cyrus (untreated) Montrose Water Treatment Works	<ul style="list-style-type: none"> Primary sewage treatment located within the site of the old Montrose airfield. All raw sewage for the Montrose area is now treated at this plant and effluent discharged into the South Esk. 		<p>Short term: Assets will continue to be protected by defences in the short term.</p> <p>Medium term: Assets will be at increased flood risk as defences fail.</p> <p>Long term: Increased frequency of flood risk to infrastructure assets.</p>	<p>Short term: Continued protection of treatment works.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued protection of treatment works.</p> <p>Medium term: As above</p> <p>Long term: As above</p>

SMP 2 Policy Scenario Area 1: Montrose					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
	<ul style="list-style-type: none"> Within the unit there are three sewage outfalls and one industrial outfall at GlaxoSmithKline. Of the three outfalls, two of these are Combined Storm Overflows (CSOs). 				
Historic Environment					
Little Kinnaber and Fisherhills Fort and Barrows Scheduled Monuments (SMs)	<ul style="list-style-type: none"> Crop mark sites identified by aerial photography 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their setting.	<p>Short term: No adverse impacts in the short term</p> <p>Medium term: No adverse impacts in the medium term</p> <p>Long term: No adverse impacts in the long term</p>	<p>Short term: No adverse impacts in the short term</p> <p>Medium term: No adverse impacts in the medium term</p> <p>Long term: No adverse impacts in the long term</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Kinnaber House	<ul style="list-style-type: none"> Listed building 		<p>Short term: No adverse impacts in the short term</p> <p>Medium term: No adverse impacts in the medium term</p> <p>Long term: No adverse impacts in the long term</p>	<p>Short term: No adverse impacts in the short term</p> <p>Medium term: No adverse impacts in the medium term</p> <p>Long term: No adverse impacts in the long term</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Montrose Airfield and associated buildings	<ul style="list-style-type: none"> Listed building 		<p>Short term: No adverse impacts in the short term</p> <p>Medium term: No adverse impacts in the medium term</p> <p>Long term: No adverse impacts in the long term</p>	<p>Short term: No adverse impacts in the short term</p> <p>Medium term: No adverse impacts in the medium term</p> <p>Long term: No adverse impacts in the long term</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Flora, fauna and biodiversity					
St Cyrus and Kinnaber Links Site of Special Scientific Interest (SSSI)	<ul style="list-style-type: none"> Notified for its coastal cliffs and dunes, vascular plants and lichens, breeding birds and insects 	<p>To maintain and enhance nationally designated conservation sites and their interest features.</p> <p>To avoid adverse impacts on, conserve and enhance the designated interest of local conservation sites</p>	<p>Short term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species.</p> <p>Medium term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species. Potential for a change in birds using the area, as a result of habitat change.</p> <p>Long term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species. Potential for a change in birds using the area, as a result of habitat change.</p>	<p>Short term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species.</p> <p>Medium term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species. Potential for a change in birds using the area, as a result of habitat change.</p> <p>Long term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species. Potential for a change in birds using the area, as a</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>

SMP 2 Policy Scenario Area 1: Montrose					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
St Cyrus National Nature Reserve (NNR) and Local Nature Reserve (LNR)	<ul style="list-style-type: none"> Important Flora and Fauna (including assemblages of breeding birds, moths, small blue butterfly and vascular plant assemblage) present in inland cliffs, sand dunes and grasslands. Important for bird watching 		<p>Short term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species.</p> <p>Medium term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species. Potential for a change in birds using the area, as a result of habitat change.</p> <p>Long term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species. Potential for a change in birds using the area, as a result of habitat change.</p>	<p>result of habitat change.</p> <p>Short term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species.</p> <p>Medium term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species. Potential for a change in birds using the area, as a result of habitat change.</p> <p>Long term: Flora and fauna in intertidal habitats (e.g. sand dunes) are likely to be maintained. However, potential flood risk to freshwater/terrestrial habitats and species. Potential for a change in birds using the area, as a result of habitat change.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
St Cyrus Scottish Wildlife Trust Nature Reserve	<ul style="list-style-type: none"> Landscape and conservation value 	To avoid adverse impacts on, conserve and enhance the designated interest of locally conservation sites.	<p>Short term: Integrity of local conservation interest features maintained.</p> <p>Medium term: Integrity of local conservation interest features maintained.</p> <p>Long term: Integrity of local conservation interest features maintained.</p>	<p>Short term: Integrity of local conservation interest features maintained.</p> <p>Medium term: Integrity of local conservation interest features maintained.</p> <p>Long term: Integrity of local conservation interest features maintained.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Fisheries					
Salmon / trout fishing	<ul style="list-style-type: none"> Both the South and North Esk Rivers are very important salmon fishing rivers. Situated at the mouth of the River North Esk are a number of fishing bothies and salmon netting stations. Upstream of their outlets both rivers are popular with anglers. 	To minimise the impact of policies on fishing activity	<p>Short term: No adverse impacts in the short term</p> <p>Medium term: No adverse impacts in the medium term unless there are significant changes in water quality</p> <p>Long term: No adverse impacts in the long term unless there are significant changes in water quality</p>	<p>Short term: No adverse impacts in the short term</p> <p>Medium term: No adverse impacts in the medium term unless there are significant changes in water quality</p> <p>Long term: No adverse impacts in the long term unless there are significant changes in water quality</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Geology and Soils					
Mixture of grade 2 and 3 agricultural land at Charleton and Kinnaber	<ul style="list-style-type: none"> Low lying and low-grade Used for rough pasture Small plantations of coniferous and deciduous trees. 	To minimise coastal flood and erosion risk to agricultural land	<p>Short term: Potential flood risk to small sections of rough grazing land adjacent to the River North Esk channel.</p> <p>Medium term: Increased flood risk to small sections of rough grazing land adjacent to the River North Esk channel.</p>	<p>Short term: Potential flood risk to small sections of rough grazing land adjacent to the River North Esk channel.</p> <p>Medium term: Increased flood risk to small sections of rough grazing land adjacent to the River North Esk</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>

SMP 2 Policy Scenario Area 1: Montrose					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
			Long term: Increased frequency of flood risk to small sections of rough grazing land adjacent to the River North Esk channel.	channel. Long term: Increased frequency of flood risk to small sections of rough grazing land adjacent to the River North Esk channel.	
Water					
Beach	<ul style="list-style-type: none"> Bay dune and spit complex covering 479 ha, extending 6km south from the River North Esk to Montrose. Consists of foredune, spit, sand-covered shingle, conifer plantations, acidic dune grassland, patches of heath and amenity grassland. 	To maintain and enhance features as a natural flood defence	<p>Short term: No adverse impacts as the beach and spit system is able to evolve naturally in the north. To the south, defences will remain and consequently the beach may narrow in front of defences, reducing its function as a natural defence line.</p> <p>Medium term: No adverse impacts as the beach and spit system is able to evolve naturally in the north. Following defence failure more sediment will be released into the beach system which may enhance the beach as a natural defence line.</p> <p>Long term: No adverse impacts as the beach and spit system is able to evolve naturally and eroded sediment will help to maintain the beach as a natural defence line as sea levels rise.</p>	<p>Short term: No adverse impacts as the beach and spit system is able to evolve naturally in the north. To the south, some upper beach restoration will help maintain the beach.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: No adverse impacts as the beach and spit system is able to evolve naturally in the north. To the south gradual roll-back of the dunes may result in some changes to the beach, particularly following defence removal.</p> <p>Medium term: As above in the north, in the south, the natural shoreline adjustment is likely to release sediment into the system, which will continue to feed the beach and maintain the beach as a natural defence.</p> <p>Long term: As above</p>
Dune system	<ul style="list-style-type: none"> Dunes run most of the length of CPU 1. St Cyrus and Kinnaber Links is one of the richest coastal habitats in the North East of Scotland. The northern extent of Montrose Bay and Kinnaber Links supports a lichen rich dune heathland, foreshore and Saltmarsh 	To maintain and enhance features as a natural flood defence	<p>Short term: No adverse impacts as the dune system is able to evolve naturally in the north. To the south, defences will remain and prevent dunes acting as a form of defence.</p> <p>Medium term: No adverse impacts as the dune system is able to evolve naturally in the north. Following defence failure dunes will erode back relatively quickly to a more natural alignment. Over time the dune system will form a more natural defence.</p> <p>Long term: No adverse impacts as the beach and spit system is able to evolve naturally.</p>	<p>Short term: No adverse impacts as the dune system is able to evolve naturally in the north. Some dune management will be undertaken under a managed realignment policy along the golf course frontage to maintain the integrity of the dunes as a natural flood defence.</p> <p>To the south, defences will remain and prevent dunes acting as a form of defence.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: No adverse impacts as the dune system is able to evolve naturally in the north. Some dune management will be undertaken under a managed realignment policy to the south and along the golf course frontage to maintain the integrity of the dunes as a natural flood defence.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Waterbodies include (but are not limited to) the following: <ul style="list-style-type: none"> Couts Rock to Scudie Ness Coastal Water Body (ID 200084) River North Esk (Confluence with Cruick Water to Estuary) River Water Body (ID 5700) Montrose bedrock and localised sand and gravel aquifers Ground Water 	<ul style="list-style-type: none"> All estuaries, coastal waters and where relevant rivers, lakes and groundwater within the study area must achieve a standard of 'good status' by 2015 under the terms of the EU Water Framework Directive (WFD); whereby 'status' is a measure of ecological, chemical, hydrological and morphological quality in surface waters. 	To support the achievement of good ecological and chemical status under the EU WFD	<p>Short term: Natural processes of coastal waterbody will not be constrained. Potential for saline intrusion to affect groundwater and river waterbodies, but as a natural process this would be compatible with WFD objectives.</p> <p>Medium term: As above.</p> <p>Long term: As above.</p>	<p>Short term: The dune and cliff systems to the north and the dune systems in the mid-reach will function near naturally, with dunes rolling backwards where topography allows this. To the south, beach restoration and stabilisation will maintain this inter-tidal feature, without significant coastal "squeeze" or detriment to the coastal water body's status.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: The dune and cliff systems to the north and the dune and beach systems in the mid-reach and to the south will function near naturally, with dunes and beaches rolling backwards where topography allows this. In the extreme south at GlaxoSmithKline beach restoration and stabilisation will maintain this inter-tidal feature, without significant detriment to the coastal water body's status.</p> <p>Medium term: As above</p>

SMP 2 Policy Scenario Area 1: Montrose					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Body (ID 150267)					Long term: As above
Landscape					
<ul style="list-style-type: none"> • Contrast between St Cyrus beach, the high St Cyrus cliffs and the River North Esk • Dune systems • Montrose town, Golf Links and the Glaxo site 	<ul style="list-style-type: none"> • Local landscape characteristics contribute to the scenic attractiveness of the area. • The Glaxo site is conspicuous in the southern part of this site. 	To enhance the aesthetic and landscape character of the coastline.	<p>Short term: Allowing natural processes will maintain the landscape character to the north.</p> <p>Medium term: Allowing natural processes will maintain the landscape character to the north. Failing defences and rapid erosion following defence failure may negatively impact on the landscape.</p> <p>Long term: Allowing natural processes will maintain the landscape character to the north. Potentially negative impacts on landscape associated with defence failure in the south; however the frontage will start to evolve to a more natural landscape over time.</p>	<p>Short term: Allowing natural processes will maintain the landscape character to the north. Maintaining the defences in the south is unlikely to change the character of the landscape but will maintain the unnatural alignment of the coast.</p> <p>Medium term: Allowing natural processes will maintain the landscape character to the north. As more substantial defences are required in the south, the upgrading of defences has the potential to change the character of the landscape and defence works would need to be designed in a sympathetic manner to the local environment.</p> <p>Long term: As above</p>	<p>Short term: Allowing natural processes with some dune management will maintain the landscape character of the coastline.</p> <p>Medium term: As above</p> <p>Long term: As above</p>

The accompanying shoreline interaction and response appraisal for Scenario Area 1 – Montrose is included in Section **G2.1 Montrose**

G3.2 Montrose Basin

Table G3.3 Montrose Basin alternative policies to test

SMP 2 Policy Scenario Area 2: Montrose Basin						
SMP 2 Management Units	Policies to test – Scenario A			Policies to test – Scenario B		
	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs
MU 2/1 (a) Montrose Port (north bank – Glaxo to A92 bridge)	HTL	HTL	HTL	As Policy Scenario A		
MU 2/1 (b) Montrose Port (south bank –A92 bridge to Ferryden)	HTL	HTL	HTL	As Policy Scenario A		
MU 2/2 (a) Montrose West (A92 Bridge to the end of railway defences)	HTL	HTL	HTL	As Policy Scenario A		
MU 2/2 (b) Montrose West (Railway defences to Tayock River)	HTL	HTL	HTL	As Policy Scenario A		
MU 2/3 (a) Tayock (Tayock village)	HTL	HTL	HTL	As Policy Scenario A		
MU 2/3 (b) Tayock (Sleepyhillock Cemetery)	HTL	HTL	HTL	NAI	NAI	NAI
MU 2/4 West Montrose Basin (west of Tayock to Old Montrose)	HTL	HTL	HTL	MR	MR	MR
MU 2/5 Old Montrose to Railway Bridge	NAI	NAI	NAI	As Policy Scenario A		
MU 2/6 Rossie Island to A92	HTL	HTL	HTL	As Policy Scenario A		
MU 2/7 Ferryden	HTL	HTL	HTL	As Policy Scenario A		
MU 2/8 Ferryden to Scurdie Ness	NAI	NAI	NAI	As Policy Scenario A		

Key: hold the line (HTL); managed realignment (MR); no active intervention (NAI)

Table G3.4 Montrose Basin alternative policy scenarios objective appraisal

SMP 2 Policy Scenario Area 2: Montrose Basin					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Population and Human Health					
Residential development	<ul style="list-style-type: none"> Town of Montrose has a population of 11,742 that has the potential to be affected by changes in SMP policy 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans.	<p>Short term: Defences remain providing flood protection to Montrose.</p> <p>Medium term: As defences fail, potential flood risk to low lying areas in the south of Montrose and on Rossie Island.</p> <p>Long term: Increased flood risk to low lying areas in the south of Montrose and on Rossie Island.</p>	<p>Short term: Continued flood protection to Montrose Town.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Recreational activities	<ul style="list-style-type: none"> The majority of small boating activity takes place on the west shore at the Montrose Sailing Club. Net fishing still within the season and bait-digging amounting to about 4 tonnes per season. Coastal walks throughout the basin Birdwatching at the Scottish Wildlife 	To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities	<p>Short term: Minimal impact to recreational activities.</p> <p>Medium term: As defences fail, potential flood risk to coastal walks (note the wildlife visitor centre is considered separately below).</p> <p>Long term: Increased flood risk to coastal walks and the wildlife visitor centre.</p>	<p>Short term: Minimal impact on recreational activities.</p> <p>Medium term: No adverse impacts on most recreational activities, except in MU2.5 and 2.8, where there will be an increasing flood risk to some coastal walks and the wildlife visitor centre.</p> <p>Long term: As above</p>	<p>Short term: Minimal impact on recreational activities.</p> <p>Medium term: Minimal impacts on most recreational activities, although there will be an increasing flood risk to some coastal walks and the wildlife visitor centre.</p>

SMP 2 Policy Scenario Area 2: Montrose Basin					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
	visitor centre also attracts a range of visitors.				Long term: As above
Sleepyhillock Cemetery	<ul style="list-style-type: none"> Cemetery on northern edge of Montrose Basin 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans.	<p>Short term: Defences remain providing erosion protection to the cemetery.</p> <p>Medium term: As defences fail, potential erosion risk to the vegetated sloping edge of the cemetery alongside the Basin. Cemetery assets are not expected to be at risk.</p> <p>Long term: As above.</p>	<p>Short term: Continued erosion protection to the cemetery.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Historic Landfill	<ul style="list-style-type: none"> Located between the railway defences and the Tayock River 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans.	<p>Short term: Defences remain providing flood protection to the landfill.</p> <p>Medium term: As defences fail, potential flood risk to the landfill.</p> <p>Long term: Increased flood risk to the landfill.</p>	<p>Short term: Continued flood protection to the landfill.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Material Assets and Infrastructure					
(Montrose Port) Harbour Quay for national and international shipping imports / exports	<ul style="list-style-type: none"> Montrose Port provides import and export services for various agricultural and oil related businesses located within the area. Approximately 40% of the annual port traffic is oil related 	<p>To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans.</p> <p>To minimise the impact of policies on marine operations and activities</p>	<p>Short term: Defences remain providing flood protection to Montrose Port.</p> <p>Medium term: As defences fail, potential flood risk to low lying areas in the south of Montrose and on Rossie Island.</p> <p>Long term: Increased flood risk to low lying areas in the south of Montrose and on Rossie Island.</p>	<p>Short term: Continued flood protection to Montrose Port.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Main East Coast Railway	<ul style="list-style-type: none"> Main East Coast Railway situated adjacent to the foreshore, generally runs parallel to the coast in the SMP area 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Defences remain providing flood protection to East Coast Railway.</p> <p>Medium term: As defences fail, potential flood risk to the railway.</p> <p>Long term: Increased flood risk to the railway.</p>	<p>Short term: Continued flood protection to the East Coast Railway.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
A92 & access to properties along Esk Road (A935)	<ul style="list-style-type: none"> The A92 is a major transport corridor connecting the study area to other parts of the country. Local roads provide access to settlements and some other locations along the coastline. 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Defences remain providing flood protection to the A92 and A935.</p> <p>Medium term: As defences fail, potential flood risk to the A92 and A935.</p> <p>Long term: Increased flood risk to the A92 and the A935.</p>	<p>Short term: Continued flood protection to Esk Road and the A92.</p> <p>Medium term: Continued flood protection to Esk Road and the majority of the A92 with the exception of a short length on the southern side of Montrose Basin</p> <p>Long term: As above</p>	<p>Short term: Continued flood protection to Esk Road and the A92.</p> <p>Medium term: Continued flood protection to Esk Road and the majority of the A92 with the exception of a short length on the southern side of Montrose Basin</p> <p>Long term: As above</p>
Sewage outfall, pumping station and pipe line	<ul style="list-style-type: none"> Three outfalls all of which are combined storm outfalls 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Assets will continue to be protected by defences in the short term.</p> <p>Medium term: Assets will be at increased flood risk as defences fail.</p> <p>Long term: Increased frequency of flood risk to infrastructure assets.</p>	<p>Short term: Assets will continue to be protected by defences.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>

SMP 2 Policy Scenario Area 2: Montrose Basin					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Historic Environment					
Montrose Town Conservation Area (Outstanding)	<ul style="list-style-type: none"> An area of special architectural and historic interest. Need to ensure that proposals do not affect the preservation or enhancement of the established character and appearance. 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their setting.	<p>Short term: Conservation Area will continue to be protected by defences in the short term.</p> <p>Medium term: Conservation Area will be at increased flood risk as defences fail.</p> <p>Long term: Increased frequency of flood risk to the Conservation Area</p>	<p>Short term: Continued flood protection to the Conservation Area.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Dronners Dyke, cropmark sites at various locations around the basin, Roman camp at Dun, Bridge of Dun, including a number of locally important sites	<ul style="list-style-type: none"> These sites are a mixture of physical features and crop mark sites. Features to the south of the Basin are particularly vulnerable to erosion and flooding. 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their setting.	<p>Short term: No adverse effects as assets are located on higher land.</p> <p>Medium term: No adverse effects as assets are located on higher land.</p> <p>Long term: No adverse effects as assets are located on higher land.</p>	<p>Short term: Continued flood protection to heritage features and crop mark sites.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Flora, Fauna and Biodiversity					
Montrose Basin Ramsar site and SPA	<ul style="list-style-type: none"> Supports over 20,000 waterfowl including many internationally important species, and aggregations of non-breeding birds. 	To support natural coastal processes and maintain and enhance the integrity of internationally designated nature conservation sites and the favourable condition of their interest features	<p>Short term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Medium term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Long term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p>	<p>Short term: Potential for coastal squeeze of intertidal habitat (except along the southern part of the designation where the shoreline will be allowed to evolve naturally), with associated impacts on designated birds e.g. loss of bird roosting, nesting and feeding areas</p> <p>Medium term: As above</p> <p>Long term: As above</p> <p>Potential requirement for a Habitat Regulations Assessment (HRA) under the Conservation of Habitats and Species Regulations 2010.</p>	<p>Short term: Potential for coastal squeeze of intertidal habitat along the northern and eastern part of the basin, with associated impacts on designated birds e.g. loss of bird roosting, nesting and feeding areas</p> <p>Potential for intertidal habitat creation along the western parts of the basin in an area of previously reclaimed land.</p> <p>Medium term: As above</p> <p>Long term: As above</p> <p>Potential requirement for a Habitat Regulations Assessment (HRA) under the Conservation of Habitats and Species Regulations 2010.</p>
Montrose Basin SSSI	<ul style="list-style-type: none"> Designated for inter-tidal mudflats saltmarsh, marsh, saline lagoons, vascular plants, breeding wildfowl and wintering waders, stratigraphy 	To maintain and enhance nationally designated conservation sites and their interest features	<p>Short term: Integrity of national conservation interest features maintained.</p> <p>Medium term: Integrity of national conservation interest features maintained. Increased frequency of saltmarsh being inundated due to rising sea levels and storm surges; however, failure of defences would allow the creation of new intertidal areas and as long as vertical accretion keeps pace with sea level rise, the saltmarsh will translate landward.</p> <p>Long term: Integrity of national conservation interest features maintained. Increased frequency of saltmarsh being inundated due to rising sea levels and storm surges; however,</p>	<p>Short term: Potential for coastal squeeze of intertidal habitat (except along the southern part of the designation where the shoreline will be allowed to evolve naturally), with associated impacts on wintering waders e.g. loss of bird roosting, nesting and feeding areas</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Potential for coastal squeeze of intertidal habitat along the northern and eastern part of the basin, with associated impacts on wintering waders e.g. loss of bird roosting, nesting and feeding areas</p> <p>Potential for intertidal habitat creation along the western parts of the basin in an area of previously reclaimed land.</p> <p>Medium term: As above</p> <p>Long term: As above</p>

SMP 2 Policy Scenario Area 2: Montrose Basin					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
			failure of defences would allow the creation of new intertidal areas and as long as vertical accretion keeps pace with sea level rise, the saltmarsh will translate landward.		
Montrose Basin LNR	<ul style="list-style-type: none"> Designated for reed swamps, plant communities, wildfowl and waders and invertebrates 	To avoid adverse impacts on, conserve and enhance the designated interest of local conservation sites	<p>Short term: Integrity of local conservation interest features maintained.</p> <p>Medium term: Integrity of local conservation interest features maintained.</p> <p>Long term: Integrity of local conservation interest features maintained.</p>	<p>Short term: Potential for coastal squeeze of intertidal habitat (except along the southern part of the designation where the shoreline will be allowed to evolve naturally), with associated impacts on wildfowl, waders and invertebrates.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Potential for coastal squeeze of intertidal habitat along the northern and eastern part of the basin, with associated impacts on wildfowl, waders and invertebrates.</p> <p>Potential for intertidal habitat creation along the western parts of the basin in an area of previously reclaimed land.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Scottish Wildlife Trust Nature Reserve	<ul style="list-style-type: none"> Designated for nature conservation value Wildfowling is the only recreational use of the reserve, which is managed with approximately 250 people per season receiving permits to shoot. 	To avoid adverse impacts on, conserve and enhance the designated interest of local conservation sites	<p>Short term: Integrity of local conservation interest features maintained. Wildfowling is unlikely to be affected.</p> <p>Medium term: Integrity of local conservation interest features maintained. Wildfowling is unlikely to be affected</p> <p>Long term: Integrity of local conservation interest features maintained. Wildfowling is unlikely to be affected.</p>	<p>Short term: Potential for coastal squeeze of intertidal habitat (except along the southern part of the designation where the shoreline will be allowed to evolve naturally), with associated impacts on wildfowl, waders and invertebrates.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Potential for coastal squeeze of intertidal habitat along the northern and eastern part of the basin, with associated impacts on wildfowl, waders and invertebrates.</p> <p>Potential for intertidal habitat creation along the western parts of the basin in an area of previously reclaimed land.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Scurdie Ness Geological Conservation Review (GCR)	<ul style="list-style-type: none"> The unit provides one of the best exposures in Eastern Scotland of the deposits (a sandy layer) of the main post-glacial transgression and the only exposure of the deposits from a tsunami, which hit the eastern and northern coasts of Scotland approximately 7000 years ago. Coastal defences may have a potentially detrimental effect by altering the balance of these processes, both within the immediate vicinity of the defence and further afield. Balancing collecting pressure, public access and scientific study is another challenge for management. 	To avoid adverse impacts on, conserve and enhance the designated interest of local conservation sites	<p>Short term: Natural coastal processes are key to maintaining the integrity of the geological site through the exposure of geological features.</p> <p>Medium term: Natural coastal processes are key to maintaining the integrity of the geological site through the exposure of geological features.</p> <p>Long term: Natural coastal processes are key to maintaining the integrity of the geological site through the exposure of geological features. There may be potential however, for increased erosion of exposures with sea level rise and increased storminess.</p>	<p>Short term: Natural coastal processes are key to maintaining the integrity of the geological site through the exposure of geological features.</p> <p>Medium term: Natural coastal processes are key to maintaining the integrity of the geological site through the exposure of geological features.</p> <p>Long term: Natural coastal processes are key to maintaining the integrity of the geological site through the exposure of geological features. There may be potential however, for increased erosion of exposures with sea level rise and increased storminess.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Regionally Important Geological / Geomorphologic Site (RIGS) at Maryton		To avoid adverse impacts on, conserve and enhance the designated interest of local conservation sites	<p>Short term: Natural coastal processes are key to maintaining the integrity of the geological site through the exposure of geological features.</p> <p>Medium term: Natural coastal processes are key</p>	<p>Short term: The integrity of the site will be maintained as natural erosion continues.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>

SMP 2 Policy Scenario Area 2: Montrose Basin					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
			to maintaining the integrity of the geological site through the exposure of geological features. Long term: Natural coastal processes are key to maintaining the integrity of the geological site through the exposure of geological features.	Medium term: As above. Long term: As above	
Fisheries					
Salmon and Sea Trout fishery, sailing, angling, bait-digging	<ul style="list-style-type: none"> The Basin has traditionally been important for salmon and sea trout fishing, both having been fished commercially since 1836 but in recent years the numbers caught have declined. 	To minimise the impact of policies on fishing activity	Short term: No adverse impacts in the short term Medium term: No adverse impacts in the medium term Long term: No adverse impacts in the long term	Short term: No adverse impacts in the short term Medium term: No adverse impacts in the medium term unless there are significant changes in water quality Long term: No adverse impacts in the long term unless there are significant changes in water quality	Short term: As Scenario A Medium term: As Scenario A Long term: As Scenario A
Geology and soils					
Mainly grade 3 agricultural land, with small areas of grade 2	<ul style="list-style-type: none"> The agricultural land around the basin is low lying with the majority being grade 3 used mainly for grazing, with a number of grade 2 stretches located in the south east corner of the basin utilised for arable farming. Due to the low-lying nature of the area, fields close to the shore have a tendency to flood during wet periods. 	To minimise coastal flood and erosion risk to agricultural land	Short term: Potential flood risk to agricultural land to the west of the Basin. Medium term: Increased flood risk to agricultural land to the west of the Basin. Long term: Increased frequency of flood risk to agricultural land to the west of the Basin.	Short term: Protection of agricultural land. Medium term: As above Long term: As above	Short term: Flooding of some agricultural land in a realigned area to the west of the Basin with associated loss of productivity. Protection of agricultural land elsewhere. Medium term: As above Long term: As above
Water					
Water bodies include (but are not limited to) the following: <ul style="list-style-type: none"> Montrose Basin Transitional Water Body (ID 200079) River South Esk River Water Body (ID 5799) Montrose bedrock and localised sand and gravel aquifers Ground Water Body (ID 150267) 	<ul style="list-style-type: none"> All estuaries, coastal waters and where relevant rivers, lakes and groundwater within the study area must achieve a standard of 'good status' by 2015 under the terms of the EU Water Framework Directive (WFD); whereby 'status' is a measure of ecological, chemical, hydrological and morphological quality in surface waters. 	To support the achievement of good ecological and chemical status under the EU WFD	Short term: Natural processes of coastal and transitional water bodies will not be constrained. Potential for limited saline intrusion to groundwater and surface water bodies, but as a natural process this would be compatible with WFD objectives. Medium term: As above. Long term: As above.	Short term: Maintaining the defence line along the northern and western shores of Montrose Basin will result in gradual loss of mudflats over the majority of the water body's undeveloped perimeter, with potential deleterious effects on water body status for example by impacting benthic invertebrates. Natural evolution along the southern shore will continue. Medium term: As above Long term: As above	Short term: Maintaining the defence line along the northern shores of Montrose Basin will result in gradual loss of mudflats over a significant percentage of the water body's perimeter, with potential deleterious effects on water body status for example by impacting benthic invertebrates. However, the majority of the shore along the west and south will continue to evolve naturally. Medium term: As above Long term: As above
Landscape					
Relatively undeveloped natural estuarine ecosystem Mudflats, sands, mussel beds, channels and areas of algae create a varied	<ul style="list-style-type: none"> Mudflats dominate the landscape within Montrose Basin. 	To enhance the aesthetic value and landscape character of the coastline	Short term: Allowing natural processes will maintain the landscape character of the Basin. Failing defences and slow erosion following defence failure may impact on the landscape of the Basin. Medium term: Allowing natural processes will	Short term: Maintaining the defences in the northern, eastern and western parts of the basin may change the character of the landscape through the gradual loss of mudflats. Allowing natural processes in the south of the	Short term: Maintaining the defences in the eastern part of the basin may change the character of the landscape through the gradual loss of mudflats. Allowing natural

SMP 2 Policy Scenario Area 2: Montrose Basin					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
<p>landscape</p> <p>Montrose town with its tall spire, the Harbour and the main East Coast Railway bind the Basin along its eastern side.</p> <p>The north shore of the Basin is agricultural land, mostly used for arable farming.</p>			<p>maintain the landscape character of the Basin. Failure of defences at Montrose and Ferryden may significantly change the landscape in these areas.</p> <p>Long term: Allowing natural processes will maintain the landscape character of the Basin. Failure of defences at Montrose and Ferryden may significantly change the landscape in these areas.</p>	<p>basin will maintain the existing landscape character.</p> <p>Medium term: As more substantial defences are required in the northern, eastern and western parts of the basin, the upgrading of defences has the potential to change the character of the landscape and defence works would need to be designed in a sympathetic manner to the local environment.</p> <p>Allowing natural erosional processes will maintain the landscape character in the south.</p> <p>Long term: As above</p>	<p>processes elsewhere is likely to be beneficial to the existing landscape character, though there is likely to be a visible change in land use in the western parts of the basin, as some parts of the reclaimed land is allowed to flood and set-back embankments are constructed.</p> <p>Medium term: As more substantial defences are required in the eastern part of the basin, the upgrading of defences has the potential to change the character of the landscape and defence works would need to be designed in a sympathetic manner to the local environment.</p> <p>Allowing natural processes elsewhere is likely to be beneficial to the existing landscape character.</p> <p>Long term: As above</p>

The accompanying shoreline interaction and response appraisal for Scenario Area 2 – Montrose Basin is included in Section **G2.2 Montrose Basin**

G3.3 Scurdie Ness to Rickle Craig

Table G3.5 Scurdie Ness to Rickle Craig alternative policies to test

SMP 2 Policy Scenario Area 3: Scurdie Ness to Rickle Craig						
SMP 2 Management Units	Policies to test – Scenario A			Policies to test – Scenario B		
	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs
MU 3/1 Scurdie Ness to Rickle Craig	NAI	NAI	NAI			
Key: no active intervention (NAI)						

Table G3.6 Scurdie Ness to Rickle Craig alternative policy scenarios objective appraisal

SMP 2 Policy Scenario Area 3: Scurdie Ness to Rickle Craig					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Population and Human Health					
Recreational activities	<ul style="list-style-type: none"> Precious gem collecting Birdwatching Sea angling 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: No adverse impacts</p> <p>Medium term: No adverse impacts</p> <p>Long term: No adverse impacts</p>	<p>Short term: No adverse impacts</p> <p>Medium term: No adverse impacts</p> <p>Long term: No adverse impacts</p>	
Material Assets and Infrastructure					
East coast Rail line	<ul style="list-style-type: none"> Situated adjacent to the foreshore. 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Minimal erosion risk to the railway, but potential risk of cliff falls.</p> <p>Medium term: Minimal erosion risk to the railway, but potential risk of cliff falls.</p> <p>Long term: Minimal erosion risk to the railway, but potential risk of cliff falls.</p>	<p>Short term: Minimal erosion risk to the railway, but potential risk of cliff falls. Risk to the railway would be monitored.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Minor farm access roads	<ul style="list-style-type: none"> Local roads provide access to settlements and some other locations along the coastline. 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Minimal erosion risk to farm access routes, but potential risk of cliff falls.</p> <p>Medium term: Minimal erosion risk to farm access routes, but potential risk of cliff falls.</p> <p>Long term: Minimal erosion risk to farm access routes, but potential risk of cliff falls.</p>	<p>Short term: Minimal erosion risk to farm access routes, but potential risk of cliff falls.</p> <p>Medium term: Minimal erosion risk to farm access routes, but potential risk of cliff falls.</p> <p>Long term: Minimal erosion risk to farm access routes, but potential risk of cliff falls.</p>	
Small harbours	<ul style="list-style-type: none"> Usan (small and natural) harbour 	To minimise the impact of policies on marine operations and activities	<p>Short term: No adverse impacts on small harbour activities.</p> <p>Medium term: No adverse impacts on small harbour activities.</p> <p>Long term: No adverse impacts on small harbour activities.</p>	<p>Short term: No adverse impacts on small harbour activities.</p> <p>Medium term: No adverse impacts on small harbour activities.</p> <p>Long term: No adverse impacts on small harbour activities.</p>	
Historic Environment					
Scurdie Ness West beacon, Montrose Leading Lights,	<ul style="list-style-type: none"> B listed structure. 	To minimise coastal flood and erosion	<p>Short term: Minimal erosion predicted,</p>	<p>Short term: Minimal erosion predicted, therefore minimal impacts</p>	

SMP 2 Policy Scenario Area 3: Scurdie Ness to Rickle Craig					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Scurdie Ness Lighthouse		risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their setting.	therefore minimal impacts on these structures. Medium term: Minimal erosion predicted, therefore minimal impacts on these structures. Long term: Minimal erosion predicted; however, there may be potential impact on these structures from cliff falls.	on these structures. Medium term: Minimal erosion predicted, therefore minimal impacts on these structures. Long term: Minimal erosion predicted; however, there may be potential impact on these structures from cliff falls.	
Boddin Point Lime Kilns	<ul style="list-style-type: none"> Grade B listed building and Site of Local Importance 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their setting.	Short term: Continued erosion risk to Lime Kilns, loss of parts of historic asset. Medium term: Increased erosion risk to Lime Kilns and loss of parts of historic asset. Long term: Potential loss of lime kilns.	Short term: Continued erosion risk to Lime Kilns, loss of parts of historic asset. Medium term: Increased erosion risk to Lime Kilns and loss of parts of historic asset. Long term: Potential loss of lime kilns.	
Fishtown of Usan, Old Ice house and lookout Tower	<ul style="list-style-type: none"> Grade C listed harbour and Sites of Local Importance 		Short term: No adverse impacts. Medium term: No adverse impacts. Long term: No adverse impacts.	Short term: No adverse impacts. Medium term: No adverse impacts. Long term: No adverse impacts.	
Usan Village, Salt House, Chapel of St Skate and usan Harbour	<ul style="list-style-type: none"> Grade B/C listed buildings and Sites of Local Importance 		Short term: No adverse impacts. Medium term: No adverse impacts. Long term: No adverse impacts.	Short term: No adverse impacts. Medium term: No adverse impacts. Long term: No adverse impacts.	
Flora, fauna and biodiversity					
Rickle Craig to Scurdie Ness SSSI	<ul style="list-style-type: none"> Saltmarsh, coastal grassland, snails, geology 	To avoid adverse impacts on, conserve and enhance the designated interest of locally conservation sites.	Short term: Natural processes are allowed to continue, which is likely to be beneficial to the nationally designated site. Potential for loss of existing saltmarsh due to ongoing erosion under storm conditions. Medium term: As above Long term: As above	Short term: Natural processes are allowed to continue, which is likely to be beneficial to the nationally designated site. Potential for loss of existing saltmarsh due to ongoing erosion under storm conditions but this will not be a result of SMP policy. Medium term: As above Long term: As above	
Scurdie Ness GCR site Usan Harbour GCR site The area around Scurdie Ness	<ul style="list-style-type: none"> Provides the best section through Old Red Sandstone lavas and associated sedimentary rocks of the Montrose Volcanic Formation in Scotland. Area around Scurdie Ness is a GCR site in its own right for its mineralogy – due to the presence of these agates (some of which are gem quality) within the lavas. 	To avoid adverse impacts on, conserve and enhance the designated interest of locally conservation sites.	Short term: Integrity of local conservation interest features maintained. Medium term: Integrity of local conservation interest features maintained. Long term: Integrity of local conservation interest features maintained.	Short term: Integrity of local conservation interest features maintained. Medium term: Integrity of local conservation interest features maintained. Long term: Integrity of local conservation interest features maintained.	
Geology and Soils					
Mainly grade 3 agricultural land with grade 2 situated	<ul style="list-style-type: none"> Agriculture is the predominant land use within the unit. 	To minimise coastal flood and erosion risk to agricultural land	Short term: Minimal loss of agricultural land to erosion.	Short term: Minimal loss of agricultural land to erosion.	

SMP 2 Policy Scenario Area 3: Scurdie Ness to Rickle Craig					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
inland	<ul style="list-style-type: none"> The agricultural land situated between Scurdie Ness and Boddin Point is of good agricultural quality with the majority being grade 3, and a small area of grade 2 located around the Usan area. The area is sparsely populated containing a number of farmhouses, cottages and the small settlement of Usan. 		<p>Medium term: Minimal loss of agricultural land to erosion.</p> <p>Long term: Minimal loss of agricultural land to erosion.</p>	<p>Medium term: Minimal loss of agricultural land to erosion.</p> <p>Long term: Minimal loss of agricultural land to erosion.</p>	
Water					
Water bodies include (but are not limited) to the following): <ul style="list-style-type: none"> Scurdie Ness to Deils Head Coastal Water Body (ID 200078) Montrose bedrock and localised sand and gravel aquifers Ground Water Body (ID 150267) 	<ul style="list-style-type: none"> All estuaries, coastal waters and where relevant rivers, lakes and groundwater within the study area must achieve a standard of 'good status' by 2015 under the terms of the EU Water Framework Directive (WFD); whereby 'status' is a measure of ecological, chemical, hydrological and morphological quality in surface waters. 	To support the achievement of good ecological and chemical status under the EU WFD	<p>Short term: Natural processes of coastal water body (and any other water body) will not be constrained.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Natural processes of coastal water body (and any other water body) will not be constrained.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Landscape					
Cliffed headland and rock platform Isolated shingle / sand beaches Small old fishing village of Usan	<ul style="list-style-type: none"> Scurdie Ness to Boddin Point is one of two significant lengths of rocky shore within the SMP area. Predominantly wave-cut rock platform and cliffs with a beach at Fishtown of Usan. Usan, 5km south of Montrose, is a small beach area (70m x 20m wide) of coarse sand and shingle 	To enhance the aesthetic and landscape character of the coastline	<p>Short term: Allowing natural processes to continue will maintain the landscape character.</p> <p>Medium term: Allowing natural processes to continue will maintain the landscape character.</p> <p>Long term: Allowing natural processes to continue will maintain the landscape character overall. As sea levels rise, the rock platform may become submerged and pocket beaches may narrow, resulting in a change in landscape character.</p>	<p>Short term: Allowing natural processes to continue will maintain the landscape character.</p> <p>Medium term: Allowing natural processes to continue will maintain the landscape character.</p> <p>Long term: Allowing natural processes to continue will maintain the landscape character overall. As sea levels rise, the rock platform may become submerged and pocket beaches may narrow, resulting in a change in landscape character.</p>	

The accompanying shoreline interaction and response appraisal for Scenario Area 3 – Scurdie Ness to Rickle Craig is included in Section G2.3 Scurdie Ness to Rickle Craig

G3.4 Lunan Bay

Table G3.7 Lunan Bay alternative policies to test

SMP 2 Policy Scenario Area 4: Lunan Bay						
SMP 2 Management Units	Policies to test – Scenario A			Policies to test – Scenario B		
	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs
MU 4/1 (a) Lunan Bay	NAI	NAI	NAI	As Policy Scenario A		
MU 4/1 (b) Corbie Knowe	NAI	NAI	NAI	HTL	NAI	NAI

Key: hold the line (HTL); no active intervention (NAI)

Table G3.8 Lunan Bay alternative policy scenarios objective appraisal

SMP 2 Policy Scenario Area 4: Lunan Bay					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Population and Human Health					
Some residential property and B&B behind dunes at Lunan	<ul style="list-style-type: none"> Several farm houses and cottages located along the unit 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans	<p>Short term: Properties set back from flood risk area, no adverse impacts.</p> <p>Medium term: Properties set back from flood risk area, no adverse impacts</p> <p>Long term: Properties set back from flood risk area, no adverse impacts</p>	<p>Short term: Properties set back from flood risk area, no adverse impacts.</p> <p>Medium term: Properties set back from flood risk area, no adverse impacts</p> <p>Long term: Properties set back from flood risk area, no adverse impacts</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Holiday chalets at Corbie Knowe	<ul style="list-style-type: none"> Small community of holiday homes located in the southern corner at Corbie Knowe 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans	<p>Short term: Erosion risk to holiday homes as defences fail.</p> <p>Medium term: Increased risk and potential loss of some holiday homes.</p> <p>Long term: Loss of holiday homes to erosion.</p>	<p>Short term: Erosion risk to holiday homes as defences fail.</p> <p>Medium term: Increased risk and potential loss of some holiday homes.</p> <p>Long term: Loss of holiday homes to erosion.</p>	<p>Short term: Existing defence will be maintained until they reach the end of their effective life, providing short term protection to properties. However, defences are unlikely to prevent damage to frontal property under storm events from the north-east.</p> <p>Medium term: Increased erosion risk to holiday homes following defence failure</p> <p>Long term: As Scenario A</p>
Recreational activities	<ul style="list-style-type: none"> Lunan Bay is one of the most popular recreational bathing waters within the Angus area, offering a sheltered bay location with fine sand and shallow waters. Due to its popularity, human erosion of the dunes continues to be a serious problem. An attempt to address this problem has been through the construction of formal access to the beach by boardwalks running from the car park to various locations on the beach. Other activities include horse riding on the beach and water sports (Windsurfing, surfing, sand sailing, sea kayaking). 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: The Bay and dunes are likely to remain stable, minimal impact on recreational activities.</p> <p>Medium term: The Bay and dunes are likely to remain stable, minimal impact on recreational activities.</p> <p>Long term: The Bay and dunes are likely to remain stable, minimal impact on recreational activities. However, if dunes erode and deteriorate due to human activities and wave erosion, there may be an impact on recreational activities.</p>	<p>Short term: The Bay and dunes are likely to remain stable, minimal impact on recreational activities.</p> <p>Medium term: The Bay and dunes are likely to remain stable, minimal impact on recreational activities.</p> <p>Long term: The Bay and dunes are likely to remain stable, minimal impact on recreational activities. However, if dunes erode and deteriorate due to human activities and wave erosion, there may be an impact on recreational activities.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
Designated bathing beach	<ul style="list-style-type: none"> North Lunan Bay beach 	To enhance the tourism value of the	Short term: Natural processes will continue,	Short term: Natural processes will	Short term: As Scenario A

SMP 2 Policy Scenario Area 4: Lunan Bay					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
		coast and aim to incorporate and improve recreation, tourism and visitor management	therefore no adverse impacts. Medium term: Natural processes will continue, therefore no adverse impacts. Long term: Natural processes will continue, therefore no adverse impacts.	continue, therefore no adverse impacts. Medium term: Natural processes will continue, therefore no adverse impacts. Long term: Natural processes will continue, therefore no adverse impacts.	Medium term: As Scenario A Long term: As Scenario A
Material Assets and Infrastructure					
Minor access road and car park at Lunan	<ul style="list-style-type: none"> Local roads provide access to settlements and some other locations along the coastline 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	Short term: No adverse impacts. Medium term: No adverse impacts. Long term: No adverse impacts.	Short term: No adverse impacts. Medium term: No adverse impacts. Long term: No adverse impacts.	Short term: As Scenario A Medium term: As Scenario A Long term: As Scenario A
Historic Environment					
Black jack, Red Castle, Newbarns and Corbie Knowe	<ul style="list-style-type: none"> Scheduled monuments e.g. Corbie Knowe - a small artificial mound perched high above the beach A-listed building e.g. Redcastle - founded by William the Lion as a hunting seat in the 12th Century. Sites of local importance e.g. World War II anti-tank blocks at Lunan Water, which are very vulnerable to erosion 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their settings	Short term: Heritage properties on higher ground, no adverse impacts. Continued erosion of anti-tank blocks at Lunan Water. Medium term: Heritage properties on higher ground, no adverse impacts. Continued erosion / loss of anti-tank blocks at Lunan Water. Long term: Heritage properties on higher ground, no adverse impacts. Continued erosion / loss of anti-tank blocks at Lunan Water.	Short term: Heritage properties on higher ground, no adverse impacts. Continued erosion of anti-tank blocks at Lunan Water. Medium term: Heritage properties on higher ground, no adverse impacts. Continued erosion / loss of anti-tank blocks at Lunan Water. Long term: Heritage properties on higher ground, no adverse impacts. Continued erosion / loss of anti-tank blocks at Lunan Water.	Short term: As Scenario A Medium term: As Scenario A Long term: As Scenario A
Flora, fauna and biodiversity					
Northern 1km of Whiting Ness to Ethie Haven SSSI covering the intertidal rock platform at Ethie Haven to the mouth of Keilor Burn	<ul style="list-style-type: none"> Coastal grassland, cliffs (rock-ledge plant communities), Bryophyte, Invertebrates and breeding birds (the largest breeding seabird colony in Tayside) Various invertebrates including Lepidoptera. Old Red Sandstone igneous Non-marine Devonian stratigraphy 	To maintain and enhance nationally designated conservation sites and their interest features	Short term: Integrity of conservation interest features maintained. Medium term: Integrity of conservation interest features maintained. Long term: Integrity of conservation interest features maintained.	Short term: Integrity of conservation interest features maintained. Medium term: Integrity of conservation interest features maintained. Long term: Integrity of conservation interest features maintained.	Short term: As Scenario A Medium term: As Scenario A Long term: As Scenario A
Fisheries					
Fishing	<ul style="list-style-type: none"> The bay is very popular for salmon fishing with netting stations placed to the north and south of the Lunan Water 	To minimise the impact of policies on fishing activity	Short term: No adverse impacts Medium term: No adverse impacts Long term: No adverse impacts	Short term: No adverse impacts Medium term: No adverse impacts Long term: No adverse impacts	Short term: As Scenario A Medium term: As Scenario A Long term: As Scenario A
Geology and Soils					
Mainly grade 3 agricultural land	<ul style="list-style-type: none"> Agriculture is of good quality and the predominant land use within the unit of Lunan Bay Approximately a 25-75% split between grade 2 and 3 land. 	To minimise coastal flood and erosion risk to agricultural land	Short term: The beach / dune system will continue to provide a natural form of defence to the backing agricultural land. Medium term: The beach / dune system will continue to provide a natural form of defence to	Short term: The beach / dune system will continue to provide a natural form of defence to the backing agricultural land. Medium term: The beach / dune system will continue to provide a natural form of	Short term: As Scenario A Medium term: As Scenario A Long term: As Scenario A

SMP 2 Policy Scenario Area 4: Lunan Bay					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
	<ul style="list-style-type: none"> Majority of the grade 3 located adjacent to the coast Grade 2 land situated landward and at the northern and southern extremes of the bay 		<p>the backing agricultural land.</p> <p>Long term: The beach / dune system should continue to provide a natural form of defence to the backing agricultural land, however, increased erosion risk to agricultural land if dunes erode.</p>	<p>defence to the backing agricultural land.</p> <p>Long term: The beach / dune system should continue to provide a natural form of defence to the backing agricultural land; however, increased erosion risk to agricultural land if dunes erode.</p>	
Water					
<p>Water bodies include (but are not limited to) the following):</p> <ul style="list-style-type: none"> Scurdie Ness to Deil's Head Coastal Water Body (ID 200078) Lunan Water River Water Body (5900) Montrose bedrock and localised sand and gravel aquifers Ground Water Body (ID 150267) Arbroath bedrock and localised sand and gravel aquifers Ground Water Body (ID 150265) 	<ul style="list-style-type: none"> All estuaries, coastal waters and where relevant rivers, lakes and groundwater within the study area must achieve a standard of 'good status' by 2015 under the terms of the EU Water Framework Directive (WFD); whereby 'status' is a measure of ecological, chemical, hydrological and morphological quality in surface waters. 	To support the achievement of good ecological and chemical status under the EU WFD	<p>Short term: Natural processes of coastal water body (and any other water body) will not be constrained.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Natural processes of coastal water body (and any other water body) will not be constrained.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Natural processes of coastal water body (and any other water body) will not be constrained.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Beach & dune system	<ul style="list-style-type: none"> The wide intertidal sand beach at Lunan Bay gently slopes into the sea and is backed by a dune ridge and raised beach (8m OD), up to 300m wide in parts. The dune ridge is at its highest (12m) and widest (100m) in the northern part of the bay Approximately 250m from High Water Mark, fossil cliffs are present at the landward edge of a raised beach. The raised beach widens to about 300m and curves to within 50m of the HWM approximately 1.5km south of Lunan water 	To maintain and enhance features as a natural flood defence	<p>Short term: Continuation of natural processes, and return to a more natural system at Corbie Knowe once defences fail, enhancing the beach and dune system as a natural defence.</p> <p>Medium term: Continuation of natural processes; beach and dune system will continue as a natural defence. However, increasing erosion of the frontal edge of the dunes as sea levels rise.</p> <p>Long term: Continuation of natural processes; increasing erosion of the frontal edge of the dunes as sea levels rise.</p>	<p>Short term: Continuation of natural processes, and return to a more natural system at Corbie Knowe once defences fail, enhancing the beach and dune system as a natural defence.</p> <p>Medium term: Continuation of natural processes; beach and dune system will continue as a natural defence. However, increasing erosion of the frontal edge of the dunes as sea levels rise.</p> <p>Long term: Continuation of natural processes; increasing erosion of the frontal edge of the dunes as sea levels rise.</p>	<p>Short term: Continuation of natural processes along the majority of the Bay with maintenance of the beach and dune system as a natural defence. Potential for lowering of the beach in the far south in front of defences.</p> <p>Medium term: Continuation of natural processes, and return to a more natural system at Corbie Knowe once defences fail, enhancing the beach and dune system as a natural defence.</p> <p>Long term: As Scenario A</p>
Landscape					
<p>A wide sweeping bay flanked at either end by cliff headlands.</p> <p>The wide intertidal sand beach gently slopes into the sea and is backed by a dune ridge and raised beach.</p> <p>The Lunan Water breaks the</p>	<ul style="list-style-type: none"> The wide intertidal beach of Lunan Bay is an important landscape feature in this CPU. 	To enhance the aesthetic value and landscape character of the coastline.	<p>Short term: Allowing natural processes will maintain the landscape character.</p> <p>Medium term: Allowing natural processes will maintain the landscape character.</p> <p>Long term: Allowing natural processes will maintain the landscape character.</p>	<p>Short term: Allowing natural processes will maintain the landscape character.</p> <p>Medium term: Allowing natural processes will maintain the landscape character.</p> <p>Long term: Allowing natural processes will maintain the landscape character.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>

SMP 2 Policy Scenario Area 4: Lunan Bay					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
dune system midway along the bay. Holiday homes at Corbie Knowe.					

The accompanying shoreline interaction and response appraisal for Scenario Area 4 – Lunan Bay is included in Section **G2.4 Lunan Bay**

G3.5 Lang Craig to Whiting Ness

Table G3.9 Lang Craig to Whiting Ness alternative policies to test

SMP 2 Policy Scenario Area 5: Lang Craig to Whiting Ness						
SMP 2 Management Units	Policies to test – Scenario A			Policies to test – Scenario B		
	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs
MU 5/1 Lang Craig to Whiting Ness	NAI	NAI	NAI			

Key: no active intervention (NAI)

Table G3.10 Lang Craig to Whiting Ness alternative policy scenarios objective appraisal

SMP 2 Policy Scenario Area 5: Lang Craig to Whiting Ness					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Population and Human Health					
Small residential development at Ethie Haven and Auchmithie	<ul style="list-style-type: none"> Further farm and private dwellings located along the unit. 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans	<p>Short term: No adverse impacts.</p> <p>Medium term: No adverse impacts.</p> <p>Long term: No adverse impacts.</p>	<p>Short term: No adverse impacts.</p> <p>Medium term: No adverse impacts.</p> <p>Long term: No adverse impacts.</p>	
Recreational activities	<ul style="list-style-type: none"> The cliff area attracts many visitors, both locals and tourists. The cliff walk is widely used because it is located close to Arbroath and it offers access to the coast, with views, archaeological interests, bird watching etc. Birdwatching from beach of cliffs Sea angling from cliffs 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Potential erosion risk to cliff top paths as a result of periodic cliff falls.</p> <p>Medium term: Potential erosion risk to cliff top paths as a result of periodic cliff falls.</p> <p>Long term: Potential erosion risk to cliff top paths as a result of periodic cliff falls.</p>	<p>Short term: Potential erosion risk to cliff top paths as a result of periodic cliff falls.</p> <p>Medium term: Potential erosion risk to cliff top paths as a result of periodic cliff falls.</p> <p>Long term: Potential erosion risk to cliff top paths as a result of periodic cliff falls.</p>	
Recreational beach at Auchmithie	<ul style="list-style-type: none"> Shingle beach at Auchmithie 		<p>Short term: No adverse impacts.</p> <p>Medium term: No adverse impacts.</p> <p>Long term: Potential for narrowing of the beach as sea levels rise.</p>	<p>Short term: No adverse impacts.</p> <p>Medium term: No adverse impacts.</p> <p>Long term: Potential for narrowing of the beach as sea levels rise.</p>	
Material Assets and Infrastructure					
Minor access roads	<ul style="list-style-type: none"> Local roads provide access to settlements and some other locations along the coastline. 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: No adverse impacts to most roads as located away from the cliff edge. Potential erosion risk to access roads to Auchmithie and Ethie Haven, in the form of cliff falls.</p> <p>Medium term: No adverse impacts to most roads as located away from the cliff edge. Potential erosion risk to access roads to Auchmithie and Ethie Haven, in the form of cliff falls.</p> <p>Long term: No adverse impacts to most roads as located away from the cliff edge. Potential erosion risk to access roads to Auchmithie and Ethie Haven, in the form of cliff falls.</p>	<p>Short term: No adverse impacts to most roads as located away from the cliff edge. Potential erosion risk to access roads to Auchmithie and Ethie Haven, in the form of cliff falls.</p> <p>Medium term: No adverse impacts to most roads as located away from the cliff edge. Potential erosion risk to access roads to Auchmithie and Ethie Haven, in the form of cliff falls.</p> <p>Long term: No adverse impacts to most roads as located away from the cliff edge. Potential erosion risk to access roads to Auchmithie and Ethie Haven, in the form of cliff falls.</p>	

SMP 2 Policy Scenario Area 5: Lang Craig to Whiting Ness					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
				cliff falls.	
Historic Environment					
Auchmithie Conservation Area	<ul style="list-style-type: none"> An area of special historic or architectural interest that it is desirable to preserve 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their setting.	<p>Short term: No adverse impacts on the Conservation Area</p> <p>Medium term: No adverse impacts on the Conservation Area</p> <p>Long term: No adverse impacts on the Conservation Area</p>	<p>Short term: No adverse impacts on the Conservation Area</p> <p>Medium term: No adverse impacts on the Conservation Area</p> <p>Long term: No adverse impacts on the Conservation Area</p>	
St Murdoch's Chapel, Ethie, Red Head, Prail Castle, West Mains of Ethie, Lud Castle, Maiden Castle, Forbidden Cave, Deils Heid, Needles E'e, Gaylet Pot	<ul style="list-style-type: none"> CPU5 contains seven sites that have been recognised to be of national importance and scheduled accordingly as SMS Scheduled Monuments B-Listed building : St Murdochs Chapel 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their settings	<p>Short term: Potential erosion risk to those historic assets near the cliff edge, in the form of cliff falls.</p> <p>Medium term: Potential erosion risk to those historic assets near the cliff edge, in the form of cliff falls.</p> <p>Long term: Potential erosion risk to those historic assets near the cliff edge, in the form of cliff falls.</p>	<p>Short term: Potential erosion risk to those historic assets near the cliff edge, in the form of cliff falls.</p> <p>Medium term: Potential erosion risk to those historic assets near the cliff edge, in the form of cliff falls.</p> <p>Long term: Potential erosion risk to those historic assets near the cliff edge, in the form of cliff falls.</p>	
Flora, Fauna and Biodiversity					
Whiting Ness to Ethie Haven SSSI	<ul style="list-style-type: none"> Coastal grassland, cliffs (rock-ledge plant communities), Bryophyte, and breeding birds (the largest breeding seabird colony in Tayside) Various invertebrates including Lepidoptera. Old Red Sandstone igneous Non-marine Devonian stratigraphy 	To maintain and enhance nationally designated conservation sites and their interest features	<p>Short term: Integrity of national conservation interest features maintained.</p> <p>Medium term: Integrity of national conservation interest features maintained.</p> <p>Long term: Integrity of national conservation interest features maintained.</p>	<p>Short term: Integrity of national conservation interest features maintained.</p> <p>Medium term: Integrity of national conservation interest features maintained.</p> <p>Long term: Integrity of national conservation interest features maintained.</p>	
GCR Sites <ul style="list-style-type: none"> Whiting Ness GCR Black Rock to East Comb GCR 	<ul style="list-style-type: none"> Important for studying stratigraphy and the palaeogeographic evolution and volcanic environments of the Midland Valley The Black Rock to EastComb GCR site has important research potential for studies on Lower Devonian volcanic environments 	To avoid adverse impacts on, conserve and enhance the designated interest of local conservation sites	<p>Short term: Integrity of local conservation interest features maintained.</p> <p>Medium term: Integrity of local conservation interest features maintained.</p> <p>Long term: Integrity of local conservation interest features maintained.</p>	<p>Short term: Integrity of local conservation interest features maintained.</p> <p>Medium term: Integrity of local conservation interest features maintained.</p> <p>Long term: Integrity of local conservation interest features maintained.</p>	
RIGS	<ul style="list-style-type: none"> The area from Whiting Ness to Carlingheugh Bay, which has excellent educational potential 	To avoid adverse impacts on, conserve and enhance the designated interest of local conservation sites	<p>Short term: Integrity of local conservation interest features maintained.</p> <p>Medium term: Integrity of local conservation interest features maintained.</p> <p>Long term: Integrity of local conservation interest features maintained.</p>	<p>Short term: Integrity of local conservation interest features maintained.</p> <p>Medium term: Integrity of local conservation interest features maintained.</p> <p>Long term: Integrity of local conservation interest features maintained.</p>	
Seaton Cliffs SWT Nature Reserve	<ul style="list-style-type: none"> Geodiversity value 	To avoid adverse impacts on, conserve and enhance the designated interest of local conservation sites	<p>Short term: Integrity of local conservation interest features maintained.</p> <p>Medium term: Integrity of local conservation</p>	<p>Short term: Integrity of local conservation interest features maintained.</p> <p>Medium term: Integrity of local</p>	

SMP 2 Policy Scenario Area 5: Lang Craig to Whiting Ness					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
			interest features maintained. Long term: Integrity of local conservation interest features maintained.	conservation interest features maintained. Long term: Integrity of local conservation interest features maintained.	
Soils and Geology					
Mainly grade 3 agricultural land with small pockets of grade 2 land	<ul style="list-style-type: none"> Predominant land use between Lang Craig and Whiting Ness is agricultural The agricultural land within the unit is of good quality, with approximately a 25-75% split between grade 2 and 3 land The majority of the grade 3 is located adjacent to the coast in the central section of the unit. The grade 2 land, like Lunan Bay is situated at the northern and southern ends of the unit (Lang Craig and Whiting Ness) 	To minimise coastal flood and erosion risk to agricultural land	Short term: Minimal loss of agricultural land to erosion. Medium term: Minimal loss of agricultural land to erosion. Long term: Minimal loss of agricultural land to erosion.	Short term: Minimal loss of agricultural land to erosion. Medium term: Minimal loss of agricultural land to erosion. Long term: Minimal loss of agricultural land to erosion.	
Water					
Water bodies include (but are not limited to) the following: <ul style="list-style-type: none"> Scurdie Ness to Deils Head Coastal Water Body (ID 200078) The Deils Head to Carnoustie Coastal Water Body (ID 200072) (very minor overlap only) Arbroath bedrock and localised sand and gravel aquifers Ground Water Body (ID 150265) 	<ul style="list-style-type: none"> All estuaries, coastal waters and where relevant rivers, lakes and groundwater within the study area must achieve a standard of 'good status' by 2015 under the terms of the EU Water Framework Directive (WFD); whereby 'status' is a measure of ecological, chemical, hydrological and morphological quality in surface waters. 	To support the achievement of good ecological and chemical status under the EU WFD	Short term: Natural processes of coastal water bodies (or any other water body) will not be constrained. Medium term: As above Long term: As above	Short term: Natural processes of coastal water bodies (or any other water body) will not be constrained. Medium term: As above Long term: As above	
Landscape					
Old Red Sandstone cliffs and rocky shore Sea stacks, blowholes, caves, wave cut platforms and arches, all contribute to the outstanding and unique landscape Auchmithie village and derelict Harbour	<ul style="list-style-type: none"> The stretch of sea cliffs and rocky shore is an important landscape feature in this CPU. 	To enhance the aesthetic and landscape character of the coastline.	Short term: Allowing natural processes to continue will maintain the landscape character. Medium term: Allowing natural processes to continue will maintain the landscape character. Long term: Allowing natural processes to continue will maintain the landscape quality.	Short term: Allowing natural processes to continue will maintain the landscape character. Medium term: Allowing natural processes to continue will maintain the landscape character. Long term: Allowing natural processes to continue will maintain the landscape quality.	

The accompanying shoreline interaction and response appraisal for Scenario Area 5 – Lang Craig to Whiting Ness is included in Section G2.5 Lang Craig to Whiting Ness

G3.6 Arbroath to West Haven

Table G3.11 Arbroath to West Haven alternative policies to test

SMP 2 Policy Scenario Area 6: Arbroath to West Haven									
SMP 2 Management Units	Policies to test – Scenario A			Policies to test – Scenario B			Policies to test – Scenario C		
	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs
MU 6/1 (a) Victoria Park	HTL	HTL	HTL	MR	MR	MR	As Policy Scenario A		
MU 6/1 (b) Seagate	HTL	HTL	HTL	As Policy Scenario A			As Policy Scenario A		
MU 6/2 Arbroath Harbour	HTL	HTL	HTL	As Policy Scenario A			As Policy Scenario A		
MU 6/3 Inchcape Park to Westway Road	HTL	HTL	HTL	As Policy Scenario A			As Policy Scenario A		
MU 6/4 (a) West Links to East Haven	NAI	NAI	NAI	As Policy Scenario A			HTL	HTL	HTL
MU 6/4 (b) East Haven	NAI	NAI	NAI	As Policy Scenario A			HTL	HTL	HTL
MU 6/4 (c) East Haven to West Haven	NAI	NAI	NAI	As Policy Scenario A			As Policy Scenario A		

Key: hold the line (HTL); managed realignment (MR); no active intervention (NAI)

Table G3.12 Arbroath to West Haven alternative policy scenarios objective appraisal

SMP 2 Policy Scenario Area 6: Arbroath to West Haven						
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B	Scenario C
Population and Human Health						
Residential settlements - Arbroath	<ul style="list-style-type: none"> The residential areas include the large town of Arbroath in the north of the unit and the small coastal settlement of East Haven located to the south. There are also a few sparsely populated farm dwellings. Arbroath is the largest town within Angus and supports a large proportion of the residential, recreational and commercial interests within the unit and along the Angus Coast. 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans	<p>Short term: Defences remain, risk of overtopping in the vicinity of the inner harbour and at Seagate, therefore potential flood risk to some residential properties in these areas.</p> <p>Medium term: Harbour defences remain, risk of overtopping in the vicinity of the inner harbour and at Seagate, therefore potential flood risk to some residential properties in these areas.</p> <p>Long term: Harbour defences remain in some form, increased risk of overtopping / flooding in the vicinity of the inner harbour and at Seagate.</p>	<p>Short term: Continued flood and erosion protection to Arbroath (including Victoria Park and Seagate).</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued flood and erosion protection provided to the residential areas of Arbroath (including Seagate).</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued flood and erosion protection to Arbroath (including Victoria Park and Seagate).</p> <p>Medium term: As above</p> <p>Long term: As above</p>
East Haven village	<ul style="list-style-type: none"> Small residential settlement to the south-west of Arbroath with properties located between the coastline and the railway Located in a small bay, created by a gap in the rock platform 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans	<p>Short term: Minimal risk of flooding to shoreline properties at East Haven</p> <p>Medium term: Increasing risk of flooding to shoreline properties at East Haven</p> <p>Long term: Potential for increased frequency of flooding to shoreline properties at East Haven</p>	<p>Short term: Minimal risk of flooding to shoreline properties at East Haven</p> <p>Medium term: Increasing risk of flooding to shoreline properties at East Haven</p> <p>Long term: Potential for increased frequency of flooding to shoreline properties at East Haven</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>	<p>Short term: Dune management will provide some flood protection to properties at East Haven. Risks to the village will be monitored.</p> <p>Medium term: Continued dune management and new defences will be constructed to manage the risk of flooding</p>

SMP 2 Policy Scenario Area 6: Arbroath to West Haven						
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B	Scenario C
						and erosion, if risk to village increases. Risks to the village will be monitored. Long term: As above
Small industry, harbour facilities	<ul style="list-style-type: none"> Arbroath was once the largest fishing harbour for the county although the fishing fleet has declined over recent years. There are still a small number of fishing vessels registered to the harbour, who land their catch at ports further north. Arbroath Harbour operates a commercial slipway utilised by a wide range of vessels for refitting etc 	To minimise the impact of policies on marine operations and activities	<p>Short term: Defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to some commercial assets in these areas.</p> <p>Medium term: Harbour defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to some commercial assets in these areas.</p> <p>Long term: Harbour defences remain in some form, increased risk of overtopping in the vicinity of the harbour, therefore potential flood risk to some commercial assets in these areas.</p>	<p>Short term: Continued protection of the harbour area and existing commercial assets.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued protection of the harbour area and existing commercial assets.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued protection of the harbour area and existing commercial assets.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Designated bathing waters and beach	<ul style="list-style-type: none"> “Excellent” rated EC Designated Bathing Water results at Arbroath West Links. Recreational beach at West Links Substantial improvement in water quality at Arbroath bathing water since the 1990s is linked to the pumping of local sewage to Hatton Sewage Treatment Works (STW) 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Continued lowering of the beach in front of defences.</p> <p>Medium term: Erosion of raised beach following the failure of defences at West Links will release stored sediment to the beach. Access to the beach may however, be compromised.</p> <p>Long term: Potentially no safe access to West Links Beach due to failure of defences and erosion of the raised beach.</p>	<p>Short term: Some lowering of the beach in front of the defences at Inchcape. No impacts on the designated bathing and recreational beach at West Links.</p> <p>Medium term: Lowering of the beach at Inchcape will continue. Failure of Hatton STW has the potential to reduce bathing water quality at the recreational beach at Arbroath, West Links.</p> <p>Long term: Further narrowing and potential loss of the beach at Inchcape is likely due to coastal squeeze. Amenity value of the beach at West Links may be affected by water quality issues following failure of Hatton STW.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>	<p>Short term: Some lowering of the beach in front of the defences at Inchcape. No impacts on the designated bathing and recreational beach at West Links.</p> <p>Medium term: Lowering of the beach at Inchcape will continue. No impacts on the designated bathing and recreational beach at West Links.</p> <p>Long term: Further narrowing and potential loss of the beach at Inchcape is likely due to coastal squeeze. No impacts on the designated bathing and recreational beach at West Links.</p>
Recreational assets	<ul style="list-style-type: none"> Victoria Park, East Links public park and football pitch Pleasure boats, water sports and sea angling Arbroath FC football ground Coastal Walk (Arbroath – West Haven) New promenade with access to 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Defences will provide protection to recreational assets in the short term, however there is potential for increased frequency of overtopping in the short term. No risk to Arbroath Golf Course.</p> <p>Medium term: Following defence failure, loss of parts of Victoria Park, the promenade and risk to the football ground through erosion. No risk to</p>	<p>Short term: Continued flood and erosion protection to recreational assets such as Victoria Park and Arbroath FC. However, potential flood or erosion risk to the coastal walk in some areas. No risk to Arbroath Golf Course.</p> <p>Medium term: As above – some parts of the coastal path may need to be</p>	<p>Short term: Continued flood and erosion protection to recreational assets such as Arbroath FC. However, potential flood or erosion risk to the coastal walk in some areas. Potential for a new beach to form at the expense of the recreation area at Victoria Park under a managed realignment policy. No risk to</p>	<p>Short term: Continued flood and erosion protection to recreational assets such as Victoria Park and Arbroath FC. However, potential flood or erosion risk to the coastal walk between East Haven and West Haven. No risk to Arbroath Golf Course.</p> <p>Medium term: As above –</p>

SMP 2 Policy Scenario Area 6: Arbroath to West Haven						
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B	Scenario C
	<ul style="list-style-type: none"> recreation beach at the west links area of Arbroath Arbroath Golf courses (Elliot) Cycle path 		<p>Arbroath Golf Course. Coastal paths may need to be relocated further inland.</p> <p>Long term: Ongoing loss of parts of Victoria Park and increased risk of erosion of the football ground. No risk to Arbroath Golf Course. Coastal paths may need to be relocated further inland.</p>	<p>relocated inland</p> <p>Long term: As above</p>	<p>Arbroath Golf Course.</p> <p>Medium term: As above – some parts of the coastal path may need to be relocated inland</p> <p>Long term: As above</p>	<p>parts of the coastal path between East Haven and West Haven may need to be relocated inland</p> <p>Long term: As above</p>
Contaminated land - Dowrie	<ul style="list-style-type: none"> An area of contaminated land exists at Dowrie. 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans.	<p>Short term: Defences remain in the short term providing flood / erosion protection to the area of contaminated land.</p> <p>Medium term: Failure of defences will result in erosion / flood risk to the contaminated site and potential release of contaminants.</p> <p>Long term: Increased flood / erosion risk to the contaminated site and increased risk of release of contaminants.</p>	<p>Short term: Defences remain in the short term providing flood / erosion protection to the area of contaminated land.</p> <p>Medium term: Failure of defences will result in erosion / flood risk to the contaminated site and potential release of contaminants.</p> <p>Long term: Increased flood / erosion risk to the contaminated site and increased risk of release of contaminants.</p>	<p>Short term: Defences remain in the short term providing flood / erosion protection to the area of contaminated land.</p> <p>Medium term: Failure of defences will result in erosion / flood risk to the contaminated site and potential release of contaminants.</p> <p>Long term: Increased flood / erosion risk to the contaminated site and increased risk of release of contaminants.</p>	<p>Short term: Continued flood and erosion protection to the contaminated area at Dowrie.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Material Assets and Infrastructure						
Access to Arbroath Harbour	<ul style="list-style-type: none"> The majority of the traffic in the harbour is made up of vessels operating angling/day trips and private recreational vessels The harbour has increasingly become popular with visiting yachts. 	To minimise the impact of policies on marine operations and activities	<p>Short term: Defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the access road.</p> <p>Medium term: Harbour defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the access road.</p> <p>Long term: Harbour defences remain in some form, increased risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the access road.</p>	<p>Short term: Ongoing maintenance of harbour structures will maintain operation of harbour and access road.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Ongoing maintenance of harbour structures will maintain operation of harbour and access road.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Ongoing maintenance of harbour structures will maintain operation of harbour and access road.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Sewage outfall (CSO)	<ul style="list-style-type: none"> Victoria Park, Arbroath Queens Drive, Arbroath West Links, Arbroath 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Defences remain, providing protection to outfalls and associated services.</p> <p>Medium term: Following defence failure, assets will be at increased risk of flooding / erosion.</p> <p>Long term: Increased frequency of flood / erosion risk to assets.</p>	<p>Short term: Continued protection to outfalls and associated services.</p> <p>Medium term: As above.</p> <p>Long term: As above.</p>	<p>Short term: Continued protection of Queens Drive and West Links outfalls and associated services. The outfall at Victoria Park will require potential relocation due to the managed realignment policy at Victoria Park.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>
A92 & minor access roads	<ul style="list-style-type: none"> The A92 is a major transport corridor connecting the study 	To minimise coastal flood and erosion risk to critical	<p>Short term: No adverse impacts.</p> <p>Medium term: Risk of localised flooding</p>	<p>Short term: No adverse impacts.</p> <p>Medium term: Risk of localised flooding</p>	<p>Short term: No adverse impacts.</p> <p>Medium term: Risk of localised</p>	<p>Short term: No adverse impacts.</p>

SMP 2 Policy Scenario Area 6: Arbroath to West Haven						
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B	Scenario C
	<p>area to other parts of the country.</p> <ul style="list-style-type: none"> Local roads provide access to settlements and some other locations along the coastline. 	infrastructure and maintain critical services	<p>at Elliot Roundabout.</p> <p>Long term: Risk of localised flooding at Elliot Roundabout and to the A92 near to the harbour.</p>	<p>around Elliot Roundabout.</p> <p>Long term: Risk of localised flooding at Elliot Roundabout and to the A92 near to the harbour.</p>	<p>flooding around Elliot Roundabout.</p> <p>Long term: Risk of localised flooding at Elliot Roundabout and to the A92 near to the harbour.</p>	<p>Medium term: As above</p> <p>Long term: As above</p>
Main East Coast Railway	<ul style="list-style-type: none"> Runs roughly parallel to coastline along CPU to the south of Arbroath. 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Potential for localised flooding of railway line at Hatton. Potential disruption to services.</p> <p>Medium term: Increased extent of railway at risk of flooding at Hatton. Potential disruption to services.</p> <p>Long term: Extent of railway at risk of flooding at Hatton increases. Potential disruption to services.</p>	<p>Short term: Potential for localised flooding of railway line at Hatton. Potential disruption to services.</p> <p>Medium term: Increased extent of railway at risk of flooding at Hatton. Potential disruption to services.</p> <p>Long term: Extent of railway at risk of flooding at Hatton increases. Potential disruption to services.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>	<p>Short term: Potential for localised hold the line at the railway line at Hatton.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Sewage pumping station, long sea outfall and pipe line	<ul style="list-style-type: none"> Located south of the sewage pumping station 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Sewage pumping station in land, therefore no impacts.</p> <p>Medium term: Sewage pumping station in land, therefore no impacts.</p> <p>Long term: Sewage pumping station in land, therefore no impacts.</p>	<p>Short term: Sewage pumping station in land, therefore no impacts.</p> <p>Medium term: Sewage pumping station in land, therefore no impacts.</p> <p>Long term: Sewage pumping station in land, therefore no impacts.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>	<p>Short term: Sewage pumping station in land, therefore no impacts.</p> <p>Medium term: Sewage pumping station in land, therefore no impacts.</p> <p>Long term: Sewage pumping station in land, therefore no impacts.</p>
Historic Environment						
St Ninians Well, Arbroath Harbour, Old Arbroath Harbour, Signal Tower Museum	<ul style="list-style-type: none"> SM: Site of Hospital of St John the Baptist Two B-Listed buildings Discovery of a Bronze Age cist at the cliffs of Whiting Ness Area is particularly important as it contains many burial grounds 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their settings.	<p>Short term: Defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to historic assets in this area.</p> <p>Medium term: Harbour defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to historic assets in this area.</p> <p>Long term: Harbour defences remain in some form, increased risk of overtopping in the vicinity of the harbour, therefore potential flood risk to historic assets in this area.</p>	<p>Short term: Continued flood protection of historic assets in Arbroath.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued flood protection of historic assets in Arbroath.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued flood protection of historic assets in Arbroath.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Arbroath Town Conservation Area	<ul style="list-style-type: none"> An area of special architectural and historic interest. Need to ensure that proposals do not affect the preservation or enhancement of the established character and appearance. 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their setting.	<p>Short term: Defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the Conservation Area.</p> <p>Medium term: Harbour defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the Conservation Area.</p>	<p>Short term: Continued flood protection of heritage assets in Arbroath Town Conservation Area.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued flood protection of heritage assets in Arbroath Town Conservation Area.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued flood protection of heritage assets in Arbroath Town Conservation Area.</p> <p>Medium term: As above</p> <p>Long term: As above</p>

SMP 2 Policy Scenario Area 6: Arbroath to West Haven						
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B	Scenario C
			<p>Area.</p> <p>Long term: Harbour defences remain in some form, increased risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the Conservation Area.</p>			
Oldest recorded fishing village in Scotland	<ul style="list-style-type: none"> Old Harbour was built at Arbroath in 1394 to the east of the present harbour and in front of the Old Shorehead. The existing Arbroath harbour was built in 1840; a tidal harbour, which is still in use today. 	<p>To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their setting.</p> <p>To minimise the impact of policies on marine operations and activities.</p>	<p>Short term: Defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the Old Harbour.</p> <p>Medium term: Harbour defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the Old Harbour.</p> <p>Long term: Harbour defences remain in some form, increased risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the Old Harbour.</p>	<p>Short term: Continued flood protection of harbour infrastructure.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued flood protection of harbour infrastructure.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued flood protection of harbour infrastructure.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Flora, fauna and biodiversity						
Elliot Links SSSI	<ul style="list-style-type: none"> Stable sand dune system Abandoned river meanders, which support important open dune and fen plant communities and invertebrates. 	<p>To maintain and enhance nationally designated conservation sites and their interest features</p>	<p>Short term: Likely to benefit national conservation site as dunes are allowed to evolve and roll-back naturally. However, potential flood risk to freshwater habitats and species not currently flooded.</p> <p>Medium term: Likely to benefit national conservation site as dunes are allowed to evolve and roll-back naturally. However, increased flood risk to freshwater habitats and species not currently flooded.</p> <p>Long term: Likely to benefit national conservation site as dunes are allowed to evolve and roll-back naturally. However, increased flood risk to freshwater habitats and species not currently flooded.</p>	<p>Short term: Likely to benefit national conservation site as dunes are allowed to evolve and roll-back naturally. Potential flood risk to freshwater habitats and species and potential for the creation of transitional habitat.</p> <p>Medium term: Likely to benefit national conservation site as dunes are allowed to evolve and roll-back naturally. Increasing flood risk to freshwater habitats and species and potential for the creation of transitional habitat.</p> <p>Long term: As above</p>	<p>Short term: Likely to benefit national conservation site as dunes are allowed to evolve and roll-back naturally. Potential flood risk to freshwater habitats and species and potential for the creation of transitional habitat.</p> <p>Medium term: Likely to benefit national conservation site as dunes are allowed to evolve and roll-back naturally. Increasing flood risk to freshwater habitats and species and potential for the creation of transitional habitat.</p> <p>Long term: As above</p>	<p>Short term: Localised holding the line at Elliot has the potential to constrain the natural evolution of the sand dunes along two short stretches, therefore no significant effect expected on the SSSI. No change to the existing freshwater habitats and species.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
East Haven SSSI	<ul style="list-style-type: none"> Greater Yellow Rattle Sand dune habitats 	<p>To maintain and enhance nationally designated conservation sites and their interest features</p>	<p>Short term: Integrity of national conservation interest features maintained.</p> <p>Medium term: Integrity of national conservation interest features maintained.</p> <p>Long term: Integrity of national conservation interest features maintained.</p>	<p>Short term: Likely to be beneficial to national conservation site as dunes (which may support Greater Yellow Rattle) are allowed to evolve and roll-back naturally.</p> <p>Medium term: Likely to be beneficial to national conservation site as dunes are allowed to evolve and roll-back naturally.</p>	<p>Short term: Likely to be beneficial to national conservation site as dunes (which may support Greater Yellow Rattle) are allowed to evolve and roll-back naturally.</p> <p>Medium term: Likely to be beneficial to national conservation site as dunes are allowed to evolve and roll-back naturally.</p>	<p>Short term: Localised hold the line has the potential to constrain the natural evolution of the sand dunes, adjacent to the designated site.</p> <p>Medium term: As above</p> <p>Long term: As above</p>

SMP 2 Policy Scenario Area 6: Arbroath to West Haven						
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B	Scenario C
				Long term: As above	naturally. Long term: As above	
Fisheries						
Commercial Fishing and Sea angling	<ul style="list-style-type: none"> • Small number of fishing vessels registered to the harbour, landing their catch at ports further north. • The only commercial fishing taking place is for shellfish such as prawns, crab, and lobster 	To minimise the impact of policies on fishing activity	<p>Short term: Defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the access road and knock on effects to commercial fishing.</p> <p>Medium term: Harbour defences remain, risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the access road and knock on effects to commercial fishing.</p> <p>Long term: Harbour defences remain in some form, increased risk of overtopping in the vicinity of the harbour, therefore potential flood risk to the access road and knock on effects to commercial fishing.</p>	<p>Short term: Protection of harbour infrastructure. Unlikely to be any strategic impacts on fishing activity.</p> <p>Medium term: No adverse impacts in the medium term unless there are significant changes in water quality.</p> <p>Long term: As above</p>	<p>Short term: Protection of harbour infrastructure. Unlikely to be any strategic impacts on fishing activity.</p> <p>Medium term: No adverse impacts in the medium term unless there are significant changes in water quality.</p> <p>Long term: As above</p>	<p>Short term: Protection of harbour infrastructure. Unlikely to be any strategic impacts on fishing activity.</p> <p>Medium term: No adverse impacts in the medium term unless there are significant changes in water quality.</p> <p>Long term: As above</p>
Soils and Geology						
Agricultural land	<ul style="list-style-type: none"> • The agricultural land within the unit is of a major contrast. • The land located adjacent to the shore is low-lying Class 4 land, mainly used for rough grazing purposes. • The land situated directly behind on the raised beach is Class 1 supporting a high yield of varying crops. 	To minimise coastal flood and erosion risk to agricultural land.	<p>Short term: The rock platform and beach will continue to provide protection to the Class 1 agricultural land on the raised beach. Localised areas of flooding of Class 4 land directly behind the shore.</p> <p>Medium term: The rock platform and beach will continue to provide protection to the Class 1 agricultural land on the raised beach. Localised areas of flooding of Class 4 land directly behind the shore.</p> <p>Long term: The rock platform and beach will continue to provide protection to the Class 1 agricultural land on the raised beach. Localised areas of flooding of Class 4 land directly behind the shore.</p>	<p>Short term: The rock platform and beach will continue to provide protection to the Class 1 agricultural land on the raised beach. Localised areas of flooding of Class 4 land directly behind the shore in areas of no active intervention.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: The rock platform and beach will continue to provide protection to the Class 1 agricultural land on the raised beach. Localised areas of flooding of Class 4 land directly behind the shore in areas of no active intervention.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: The rock platform and beach will continue to provide protection to the Class 1 agricultural land on the raised beach. Localised areas of flooding of Class 4 land directly behind the shore in areas of no active intervention.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Water						
Shingle / sand beaches	<ul style="list-style-type: none"> • An extensive marine abrasion platform backed by several storm beaches consisting of boulders and shingle runs along almost the entire length of CPU 6. • Acts as a breakwater for waves 	To maintain and enhance features as a natural flood defence	Short term: Where defences remain, beaches may narrow in front of defences, reducing their function of a natural defence. West of Arbroath, the beach at the dune toe will continue to provide natural protection to this stable frontage.	Short term: Where defences remain, beaches may narrow in front of defences, reducing their function of a natural defence. West of Arbroath, the beach at the dune toe will continue to provide natural protection to this stable frontage.	Short term: Where defences remain, beaches may narrow in front of defences, reducing their function of a natural defence. West of Arbroath, the beach at the dune toe will continue to provide natural protection to this	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A</p> <p>Long term: As Scenario A</p>

SMP 2 Policy Scenario Area 6: Arbroath to West Haven						
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B	Scenario C
	<p>before they reach the sandy shore.</p> <ul style="list-style-type: none"> Beach material is often lost in winter due to severe weather conditions, which also cause the beach to drop dramatically 		<p>Medium term: Erosion of raised beaches and frontal dune erosion will help maintain the defence function of beaches.</p> <p>Long term: As sea levels rise, erosion of raised beaches will release sediment into the system, helping to maintain the defence function of the beaches.</p>	<p>Medium term: As above</p> <p>Long term: As above.</p>	<p>stable frontage.</p> <p>Medium term: As above. There is potential for a new beach to form at the expense of the recreation area at Victoria Park under a managed realignment policy.</p> <p>Long term: As above.</p>	
Low frontal dune system from Elliot to Corse Hill	<ul style="list-style-type: none"> Elliot Links SSSI, south of Arbroath, is 150m wide at its northern and southern points, narrowing to 70m wide midway. The seaward edge of the links is generally a narrow strip of moderately vegetated dune ridge. Inland of the dune ridge is a stable dune area with several abandoned river meanders. Elliot has a stable sand dune system with abandoned river meanders that supports open dune and fen plant communities, which are uncommon in Angus. 		<p>Short term: A continuation of natural processes will mean no adverse effects on the stable dune system.</p> <p>Medium term: A continuation of natural processes will mean no adverse effects on the stable dune system.</p> <p>Long term: Potential erosion of the frontal dune system as sea levels rise, however the integrity of the dunes as a whole is likely to continue.</p>	<p>Short term: A continuation of natural processes will mean no adverse effects on the stable dune system.</p> <p>Medium term: A continuation of natural processes will mean no adverse effects on the stable dune system.</p> <p>Long term: Potential erosion of the frontal dune system as sea levels rise, however the integrity of the dunes as a whole is likely to continue.</p>	<p>Short term: A continuation of natural processes will mean no adverse effects on the stable dune system.</p> <p>Medium term: A continuation of natural processes will mean no adverse effects on the stable dune system.</p> <p>Long term: Potential erosion of the frontal dune system as sea levels rise, however the integrity of the dunes as a whole is likely to continue.</p>	<p>Short term: A continuation of natural processes will mean no adverse effects on the stable dune system. However, some localised defence maintenance will constrain the natural roll-back of the dune system in two short locations.</p> <p>Medium term: As above</p> <p>Long term: As above. Erosion may increase as sea levels rise.</p>
Rock platform with sand beach and frontal dunes from Corse Hill to West Haven	<ul style="list-style-type: none"> An extensive marine abrasion platform fringed by a narrow strip of sand, runs along the northern extent. 		<p>Short term: The fringing rock platforms will continue to provide protection to the shore.</p> <p>Medium term: The fringing rock platforms will continue to provide protection to the shore, however, with sea levels rise the influence of the platform may reduce as it becomes submerged</p> <p>Long term: Permanent submergence of fringing rock platforms is possible as sea levels rise, reducing their natural defence function.</p>	<p>Short term: The fringing rock platforms will continue to provide protection to the shore.</p> <p>Medium term: The fringing rock platforms will continue to provide protection to the shore, however, with sea levels rise the influence of the platform may reduce as it becomes submerged</p> <p>Long term: Permanent submergence of fringing rock platforms is possible as sea levels rise, reducing their natural defence function.</p>	<p>Short term: The fringing rock platforms will continue to provide protection to the shore.</p> <p>Medium term: The fringing rock platforms will continue to provide protection to the shore, however, with sea levels rise the influence of the platform may reduce as it becomes submerged</p> <p>Long term: Permanent submergence of fringing rock platforms is possible as sea levels rise, reducing their natural defence function.</p>	<p>Short term: The fringing rock platforms will continue to provide protection to the shore.</p> <p>Medium term: The fringing rock platforms will continue to provide protection to the shore, however, with sea levels rise the influence of the platform may reduce as it becomes submerged</p> <p>Long term: Permanent submergence of fringing rock platforms is possible as sea levels rise, reducing their natural defence function.</p>
Water bodies include (but are not limited to) the following: <ul style="list-style-type: none"> The Deils Head to Carnoustie Coastal Water Body (ID 200072) Brothock Valley Sand and Gravel Ground Water Body (ID 150272) 	<ul style="list-style-type: none"> All estuaries, coastal waters and where relevant rivers, lakes and groundwater within the study area must achieve a standard of 'good status' by 2015 under the terms of the EU Water Framework Directive (WFD); whereby 'status' is a measure of ecological, chemical, hydrological and morphological 	To support the achievement of good ecological and chemical status under the EU WFD	<p>Short term: Natural processes of coastal water body (or any other water body) will not be constrained.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Natural processes of coastal water body (or any other water body) unlikely to be constrained to any significant extent, but depends on rate of sea level rise.</p> <p>Medium term: As sea levels rise with climate change, some loss of intertidal habitats along the frontage from Victoria Park to the harbour and from</p>	<p>Short term: Natural processes of coastal water body (or any other water body) unlikely to be constrained to any significant extent, but depends on rate of sea level rise.</p> <p>Medium term: As sea levels rise with climate change, some loss of intertidal habitats is likely along</p>	<p>Short term: Natural processes of coastal water body (or any other water body) unlikely to be constrained to any significant extent, but depends on rate of sea level rise.</p> <p>Medium term: As sea levels rise with climate change, loss of intertidal habitats may be</p>

SMP 2 Policy Scenario Area 6: Arbroath to West Haven						
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B	Scenario C
<ul style="list-style-type: none"> Carnoustie bedrock and localised sand and gravel aquifers Ground Water Body (ID 150257) Elliot Water River Water Body (ID 5950) 	quality in surface waters.			<p>the harbour to Westway Road may result in deleterious effects on ecological status along a notable proportion (c.15%) of the coastal water body's shoreline. Further south, natural processes will be unconstrained.</p> <p>Long term: As above</p>	<p>the frontage either side of the harbour but could be offset by new habitat created by MR at Victoria Park, with an overall neutral effect on the ecological status of the coastal water body. Further south, natural processes will be unconstrained.</p> <p>Long term: As above</p>	<p>experienced along the majority of the frontage from Victoria Park to East Haven may result in deleterious effects on ecological status along a majority of the coastal water body's shoreline. Only along about 2km from East Haven to West Haven will natural processes be unconstrained.</p> <p>Long term: As above</p>
Landscape						
<p>Arbroath Harbour and Victoria Park</p> <p>West Links and Elliot dune systems</p> <p>East Haven village</p>	<ul style="list-style-type: none"> These features are important features contributing to the local landscape character. 	To enhance the aesthetic value and landscape character of the coastline	<p>Short term: Allowing natural processes will maintain the landscape character to the south.</p> <p>Medium term: Allowing natural processes will maintain the landscape character to the south. Failing defences and rapid erosion following defence failure may impact on the landscape at Arbroath.</p> <p>Long term: Allowing natural processes will maintain the landscape character to the south, however, potential changes in landscape character at East Haven if erosion becomes an issue in the long term. Potential impacts on landscape associated with defence failure at Arbroath, however the frontage will start to evolve to a more natural landscape over time.</p>	<p>Short term: Allowing natural processes will maintain the landscape character to the south. In the north, where defences will continue to be maintained, there will be no change to the urban landscape.</p> <p>Medium term: As above</p> <p>Long term: Allowing natural processes will maintain the landscape character to the south, however, potential changes in landscape character at East Haven if erosion becomes an issue in the long term.</p>	<p>Short term: Allowing natural processes will maintain the landscape character to the south.</p> <p>There will be a change in landscape character in the north at Victoria Park due to land use change, where there is potential to create a new beach as the raised beach erodes back under managed realignment.</p> <p>Medium term: As above</p> <p>Long term: Allowing natural processes will maintain the landscape character to the south, however, potential changes in landscape character at East Haven if erosion becomes an issue in the long term.</p> <p>There will be a change in landscape character in the north at Victoria Park due to the potential need for set-back defences.</p>	<p>Short term: As Scenario A</p> <p>Medium term: As Scenario A. New defences / dune management at East Haven will alter the landscape in this location.</p> <p>Long term: As above</p>

The accompanying shoreline interaction and response appraisal for Scenario Area 6 – Arbroath to East Haven is included in Section **G2.6 Arbroath to West Haven**

G3.7 Carnoustie

Table G3.13 Carnoustie alternative policies to test

SMP 2 Policy Scenario Area 7: Carnoustie						
SMP 2 Management Units	Policies to test – Scenario A			Policies to test – Scenario B		
	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs
MU 7/1 West Haven to Carnoustie Station	HTL	HTL	HTL			
MU 7/2 Carnoustie Station to Barry Burn	HTL	HTL	HTL			

Key: hold the line (HTL)

Table G3.14 Carnoustie alternative policy scenarios objective appraisal

SMP 2 Policy Scenario Area 7: Carnoustie					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Population and Human health					
Residential	<ul style="list-style-type: none"> The land use at West Haven is residential. 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans	<p>Short term: Defences remain in the short term providing flood protection to Carnoustie and West Haven.</p> <p>Medium term: Defences remain in the medium term providing flood protection to Carnoustie and West Haven.</p> <p>Long term: There will be risk of flooding to parts of Carnoustie and erosion risk will increase to West Haven in the long term as defences fail.</p>	<p>Short term: Continued flood protection to Carnoustie and West Haven.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Recreational assets	<ul style="list-style-type: none"> The frontage at Carnoustie is mainly recreational with golf courses and a high amenity beach with a number of leisure facilities A coastal footpath extends from the MoD boundary along the beach frontage to West Haven The main area backing the beach frontage has been upgraded over the years and includes a leisure centre, all-weather outdoor playing surfaces, children's play area, sailing club, paddling pool, car park facilities and seafront walk Carnoustie Bay is well used for boating activities by the local sailing club also popular with a number of other water sports enthusiasts as it provides a reasonably sheltered environment for surfing, wind surfing, para-surfing and canoeing. 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Defences remain in the short term, no adverse impact.</p> <p>Medium term: As defences deteriorate, recreational land will be at risk of overtopping. Following defence failure along Barry Sands East, potential for rapid erosion of the links area, back to a more natural alignment. Potential for loss of / increased flood risk to sections of the golf course.</p> <p>Long term: Potential for rapid erosion of the backing links following defence failure, back to a more natural embayment position. Loss of recreational facilities and increased flood risk to the golf course.</p>	<p>Short term: Continued flood and erosion protection to recreational assets to maintain tourism and amenity areas.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Designated bathing beach	<ul style="list-style-type: none"> The beach at Carnoustie has been identified as a designated bathing beach for purposes of EC Bathing 	To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities	Short term: The fronting beach may narrow and lower due to the reflective nature of the defences and coastal squeeze against the	Short term: The fronting beach may narrow and lower due to the reflective nature of the defences and coastal squeeze against the defences over time	

SMP 2 Policy Scenario Area 7: Carnoustie					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
	<p>Waters Directive</p> <ul style="list-style-type: none"> Children's play area, paddling pool and car park facilities 	<p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>defences over time.</p> <p>Medium term: The intertidal beach will continue to narrow and lower seaward of the remaining structures as sea levels rise.</p> <p>Long term: Potential for rapid erosion of the backing links following defence failure, providing new sediment to the beaches and enhancing the beach. Loss of access to the beach, car parks and other facilities.</p>	<p>with loss of amenity value. Continued defence maintenance will maintain the water quality of the designated bathing beach.</p> <p>Medium term: The intertidal beach will continue to narrow and lower seaward of the remaining structures as sea levels rise, with associated loss of amenity value of the beach.</p> <p>Long term: As above</p>	
Carnoustie Championship Golf Links	<ul style="list-style-type: none"> The Championship Medal Course attracts national and international visitors with an increased interest following the return of the British Open in 1999 A luxury hotel was constructed adjacent to the course in 1999 providing accommodation and conference facilities. 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Defences remain in the short term, no adverse impact.</p> <p>Medium term: Following defence failure along Barry Sands East, potential for rapid erosion of the links area, back to a more natural alignment. Defences will remain along the Carnoustie frontage, preventing erosion, but potential for increased flood risk to sections of the golf course in this section. Flood risk to the hotel adjacent to the golf course.</p> <p>Long term: Potential for rapid erosion of the backing links following defence failure, back to a more natural embayment position. Loss of / increased flood risk to parts of the golf course. Increased flood risk to the hotel adjacent to the golf course.</p>	<p>Short term: Continued protection of Championship Golf Courses</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Material Assets and Infrastructure					
Main East Coast Railway	<ul style="list-style-type: none"> Runs through Carnoustie in the northern section of this unit 	<p>To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services</p>	<p>Short term: Defences remain in the short term, no adverse impact.</p> <p>Medium term: Defences remain in the medium term, no adverse impact.</p> <p>Long term: Flood and erosion risk to the railway line, Carnoustie Station and car park facilities.</p>	<p>Short term: Continued flood and erosion protection of main east coast railway in Carnoustie.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Pumping station, sewage outfall and pipeline	<ul style="list-style-type: none"> Ballasters Park, West Haven CSO (Combined storm outfall) Pumping station is located and protected by a mixed rock/rubble revetment 	<p>To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services.</p>	<p>Short term: Potential risk of erosion to pumping station and associated infrastructure</p> <p>Medium term: As above</p> <p>Long term: Deterioration of rock armour protection at south-western corner of pumping station leading to increased erosion of pumping station and associated infrastructure</p>	<p>Short term: Continued protection of pumping station and associated assets from erosion.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Flora, fauna and biodiversity					
Part of Firth of Tay and Eden Estuary SPA (to the south of this MU)	<ul style="list-style-type: none"> Supports internationally important numbers of non-breeding waterfowl and aggregations of non-breeding bird 	<p>To support natural coastal processes and maintain and enhance the integrity of internationally designated nature conservation sites and the favourable condition of their interest features</p>	<p>Short term: Natural coastal processes will not be constrained. Integrity of adjacent international conservation interest features maintained. Dune habitats can migrate landward naturally in response to rising sea levels although there may</p>	<p>Short term: No direct impacts on the SPA site. However the continued maintenance of defences to the north of the designated site and the constraint on natural processes has the</p>	

SMP 2 Policy Scenario Area 7: Carnoustie					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
			<p>be some erosion of the dune face and breaching of the dunes from storm surges.</p> <p>Medium term: As short term</p> <p>Long term: As short term</p>	<p>potential to affect sediment supply to the SPA to the south. Continued coastal squeeze of intertidal habitat adjacent to the designated site has the potential to impact on SPA birds using the area.</p> <p>Medium term: As above</p> <p>Long term: As above</p> <p>Potential requirement for a Habitat Regulations Assessment (HRA) under the Conservation of Habitats and Species Regulations 2010.</p>	
Part of Firth of Tay and Eden Estuary Special Area of Conservation (SAC) (to the south of this MU)	<ul style="list-style-type: none"> Coastal dune heathland Shifting dunes Dune grassland Humid dune slacks Shifting dunes with marram 	To support natural coastal processes and maintain and enhance the integrity of internationally designated nature conservation sites and the favourable condition of their interest features	<p>Short term: Natural coastal processes will not be constrained. Integrity of adjacent international conservation interest features maintained. Dune habitats can migrate landward naturally in response to rising sea levels although there may be some erosion of the dune face and breaching of the dunes from storm surges.</p> <p>Medium term: As short term</p> <p>Long term: As short term</p>	<p>Short term: No direct impacts on the SAC site to the south. However the continued maintenance of defences to the north of the designated site will constrain natural processes and has the potential to affect sediment supply and the SAC dune habitats to the south.</p> <p>Medium term: As above</p> <p>Long term: As above</p> <p>Potential requirement for a Habitat Regulations Assessment (HRA) under the Conservation of Habitats and Species Regulations 2010.</p>	
Barry Links Site of Special Scientific Interest (SSSI) to the south of this MU	<ul style="list-style-type: none"> SSSI for its dune habitats and landforms, vascular plants, bryophytes, invertebrates and breeding birds 	To maintain and enhance nationally designated conservation sites and their interest features	<p>Short term: Integrity of adjacent national conservation interest features maintained. Dune habitats can migrate landward naturally in response to rising sea levels although there may be some erosion of the dune face and breaching of the dunes from storm surges. Potential flood risk to freshwater habitats and species.</p> <p>Medium term: As short term</p> <p>Long term: As short term</p>	<p>Short term: No direct impacts on the SSSI. However the continued maintenance of defences to the north of the designated site and the constraint on natural processes has the potential to affect sediment supply to the SSSI to the south. Continued coastal squeeze of intertidal habitat adjacent to the designated site has the potential to impact on SSSI interest features.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Water					
Beach and dunes	<ul style="list-style-type: none"> Barry Sands East to Buddon Ness is a wide (330m), gently sloping (1o) continuous beach backed by a large rip-rap coastal defence. A dynamic area with parabolic dunes is to the south of the defence, and submerged and inter-tidal sandbanks, the most notable being Gaa Sands, are present 	To maintain and enhance features as a natural flood defence	<p>Short term: The fronting beach may narrow and lower due to the reflective nature of the defences and coastal squeeze against the defences over time. The dune system will remain stable and intertidal rock platform will continue to provide natural protection to this stable frontage.</p> <p>Medium term: The dunes will remain relatively</p>	<p>Short term: The fronting beach may narrow and lower due to the reflective nature of the defences and coastal squeeze against the defences over time. The dune system will remain stable and intertidal rock platform will continue to provide natural protection to this stable frontage.</p>	

SMP 2 Policy Scenario Area 7: Carnoustie					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
	<p>near the shore</p> <ul style="list-style-type: none"> On areas without coastal protection at Barry, the sand naturally undergoes cycles of erosion and accretion. During summer embryonic dunes accrete on the upper beaches, but during the winters erosion occurs, the beach level drops and sand is lost to the sea or blown inland. 		<p>stable, however, the frontal dune system will be susceptible to storm damage and erosion will occur, albeit at a low rate where defences have failed. The intertidal beach will continue to narrow and lower seaward of the remaining structures as sea levels rise. The intertidal rock platform is expected to continue to provide natural protection to the frontage, however, this influence will reduce with sea level rise.</p> <p>Long term: Potential for rapid erosion of the backing links following defence failure, back to a more natural embayment position, providing new sediment to the beaches and enhancing the beach as a natural form of defence. The rock platform fronting the beach may become submerged as sea levels rise. The natural protection afforded by the rock platform to the beach will therefore diminish over time.</p>	<p>Medium term: The dunes will remain relatively stable. The intertidal beach will continue to narrow and lower seaward of the remaining structures as sea levels rise.</p> <p>Long term: As above</p>	
<p>Water bodies include (but are not limited to) the following:</p> <ul style="list-style-type: none"> The Deils Head to Carnoustie Coastal Water Body (ID 200072) (very minor overlap only) Carnoustie to Fife Ness Coastal Water Body (ID 200069) Carnoustie bedrock and localised sand and gravel aquifers Ground Water Body (ID 150257) 	<ul style="list-style-type: none"> All estuaries, coastal waters and where relevant rivers, lakes and groundwater within the study area must achieve a standard of 'good status' by 2015 under the terms of the EU Water Framework Directive (WFD); whereby 'status' is a measure of ecological, chemical, hydrological and morphological quality in surface waters. 	To support the achievement of good ecological and chemical status under the EU WFD	<p>Short term: Natural processes of coastal water body (or any other water body) will not be constrained.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Natural processes of coastal water body (or any other water body) unlikely to be constrained to any significant extent, but depends on rate of sea level rise.</p> <p>Medium term: As sea levels rise with climate change, some loss of intertidal habitats is likely along the frontage. The frontage is small compared to the full coastline of the water body, and also is likely to be a non-critical reach in terms of ecological quality. WFD objectives are unlikely to be compromised</p> <p>Long term: As above</p>	
Landscape					
<p>Carnoustie beach, shore platform and backing dunes</p> <p>Golf Course and infrastructure</p> <p>Dune systems at Buddon Ness</p>	<ul style="list-style-type: none"> Carnoustie Beach is an important feature in the landscape of this CPU 	To enhance the aesthetic value and landscape character of the coastline.	<p>Short term: Defences remain so no adverse impacts.</p> <p>Medium term: Failing defences and rapid erosion following defence failure at Barry Sands East may impact on the landscape.</p> <p>Long term: Potential impacts on landscape associated with defence failure at Carnoustie, however the Barry Sands East frontage will start to evolve to a more natural landscape over time.</p>	<p>Short term: Defences will maintain the existing landscape character of land in the hinterland. The narrowing of the beach may affect the local landscape character but no adverse strategic landscape impacts would be experienced.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	

The accompanying shoreline interaction and response appraisal for Scenario Area 7 – Carnoustie is included in Section G2.7 Carnoustie

G3.8 Buddon Ness

Table G3.15 Buddon Ness alternative policies to test

SMP 2 Policy Scenario Area 8: Buddon Ness						
SMP 2 Management Units	Policies to test – Scenario A			Policies to test – Scenario B		
	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs
MU 8/1 Barry Sands East	HTL	HTL	HTL	HTL	MR	MR
MU 8/2 Barry Buddon & Barry Sands West	NAI	NAI	NAI	As Policy Scenario A		

Key: hold the line (HTL); managed realignment (MR); no active intervention (NAI)

Table G3.16 Buddon Ness alternative policy scenarios objective appraisal

SMP 2 Policy Scenario Area 8: Buddon Ness					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Population and human health					
Informal recreational assets	<ul style="list-style-type: none"> Coastal walks / footpaths on Buddon Ness 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Flood and erosion risk to informal coastal walks on Buddon Ness.</p> <p>Medium term: As above.</p> <p>Long term: As above.</p>	<p>Short term: Flood and erosion risk to informal coastal walks on Buddon Ness.</p> <p>Medium term: As above.</p> <p>Long term: As above.</p>	
Material Assets and Infrastructure					
MoD Barry Buddon Training Camp	<ul style="list-style-type: none"> The Camp and training ground occupy the entire Barry Buddon peninsula and is owned by the Ministry of Defence (MoD). There are six dry training areas used for a variety of exercises from battle simulation to orienteering. Beach landings take place, mainly between the two lighthouses A grass airstrip has been made for the planes to pick up troops. 	To minimise coastal flood and erosion risk to industry, commercial and economic activities and Ministry of Defence land.	<p>Short term: Naturally evolving dune system, fluctuating erosion and accretion along Buddon Ness, no adverse impacts.</p> <p>Medium term: Naturally evolving dune system, fluctuating erosion and accretion along Buddon Ness, no adverse impacts. Following defence failure along Barry Sands East, potential for rapid erosion of the MoD training camp links.</p> <p>Long term: Naturally evolving dune system, fluctuating erosion and accretion along Buddon Ness, no adverse impacts.</p>	<p>Short term: Continued evolution of dune system, with fluctuating erosion and accretion along Buddon Ness, but no adverse impacts on training camp.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued evolution of dune system, with fluctuating erosion and accretion along Buddon Ness, but no adverse impacts on training camp.</p> <p>Medium term: Managed realignment at Barry Sands East may increase the risk of erosion to the MoD training camp. Potential to relocate assets inland.</p> <p>Long term: As above</p>
Barry Sands East – MoD Exclusion area	<ul style="list-style-type: none"> No access is allowed onto approximately 70 hectares because the area contains the remains of live ammunition 	To minimise coastal flood and erosion risk to industry, commercial and economic activities and Ministry of Defence land.	<p>Short term: Defences remain in the short term, no adverse impact.</p> <p>Medium term: Following defence failure along Barry Sands East, potential for rapid erosion of the MoD exclusion area, back to a more natural alignment. Potential for loss of / increased flood risk to sections of MoD exclusion area. Increased safety risk of live ammunition being impacted and potentially washed out to sea.</p> <p>Long term: Increased flood risk to and erosion of MoD exclusion area.</p>	<p>Short term: Continued protection of exclusion area and rifle ranges.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued protection of exclusion area and rifle ranges.</p> <p>Medium term: Realignment will increase the risk of erosion and flooding to the MoD exclusion area, back to a more natural alignment. Potential to relocate assets inland.</p> <p>Long term: Increased flood risk to and erosion of MoD exclusion area. Safety risks associated with live ammunition would need further consideration and management.</p>

SMP 2 Policy Scenario Area 8: Buddon Ness					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
Access to Port of Dundee	<ul style="list-style-type: none"> Access to port to be maintained 	To minimise the impact of policies on marine operations and activities	<p>Short term: No adverse impacts</p> <p>Medium term: No adverse impacts</p> <p>Long term: No adverse impacts</p>	<p>Short term: No adverse impacts</p> <p>Medium term: No adverse impacts</p> <p>Long term: No adverse impacts</p>	<p>Short term: No adverse impacts</p> <p>Medium term: No adverse impacts</p> <p>Long term: No adverse impacts</p>
Minor access roads and facilities associated with Camp	<ul style="list-style-type: none"> Local tracks on Buddon Ness to training facilities 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: No adverse impacts</p> <p>Medium term: No adverse impacts</p> <p>Long term: No adverse impacts</p>	<p>Short term: Continued protection of access tracks.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: No adverse impacts</p> <p>Medium term: No adverse impacts</p> <p>Long term: No adverse impacts</p>
Minor roads	<ul style="list-style-type: none"> Local roads provide access to settlements and some other locations along the coastline. 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	<p>Short term: Potential flood risk to minor roads.</p> <p>Medium term: Potential flood risk to minor roads increases with sea level rise.</p> <p>Long term: Potential flood risk to minor roads continues to increase with increased sea level rise.</p>	<p>Short term: Potential flood risk to some minor roads.</p> <p>Medium term: Potential flood risk to some minor roads increases with sea level rise.</p> <p>Long term: Potential flood risk to some minor roads will continue to increase with increased sea level rise.</p>	<p>Short term: Potential flood risk to minor roads.</p> <p>Medium term: Potential flood risk to minor roads increases with sea level rise.</p> <p>Long term: Potential flood risk to minor roads continues to increase with increased sea level rise.</p>
Historic Environment					
Buddon Ness: Old High Lighthouse, Low Lighthouse and ice house	<ul style="list-style-type: none"> The high lighthouse is a tall circular tower built by the Stevensons in the mid 18th Century. The low lighthouse was built by the Stevensons in the 19th Century and is a circular building like the high lighthouse Sites of local importance 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their settings	<p>Short term: Potential flood risk to Low Lighthouse</p> <p>Medium term: Increased flood risk to Low Lighthouse</p> <p>Long term: Increased frequency of flood risk to Low Lighthouse</p>	<p>Short term: Potential flood risk to Low Lighthouse</p> <p>Medium term: Increased flood risk to Low Lighthouse</p> <p>Long term: Increased frequency of flood risk to Low Lighthouse</p>	<p>Short term: Potential flood risk to Low Lighthouse</p> <p>Medium term: Increased flood risk to Low Lighthouse</p> <p>Long term: Increased frequency of flood risk to Low Lighthouse</p>
Barry Military Links: Barry Camp and Buddon Camp	<ul style="list-style-type: none"> The camp is recognised for its military importance within the 20th Century. Sites of local importance 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their settings	<p>Short term: Naturally evolving dune system, fluctuating erosion and accretion along Buddon Ness, no adverse impacts.</p> <p>Medium term: Naturally evolving dune system, fluctuating erosion and accretion along Buddon Ness, no adverse impacts. Following defence failure along Barry Sands East, potential for rapid erosion of backing dunes.</p> <p>Long term: Naturally evolving dune system, fluctuating erosion and accretion along Buddon Ness, no adverse impacts.</p>	<p>Short term: Continued evolution of dune system, with fluctuating erosion and accretion along Buddon Ness, but no adverse impacts on the historic links.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Continued evolution of dune system, with fluctuating erosion and accretion along Buddon Ness, but no adverse impacts on the historic links.</p> <p>Medium term: Potential risk to the historic links under a managed realignment policy at Barry Sands East.</p> <p>Long term: As above</p>
Flora, fauna and biodiversity					
Part of Firth of Tay and Eden Estuary SAC	<ul style="list-style-type: none"> Coastal dune heathland Shifting dunes Dune grassland Humid dune slacks Shifting dunes with marram 	To support natural coastal processes and maintain and enhance the integrity of internationally designated nature conservation sites and the favourable condition of their interest features	<p>Short term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Medium term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Long term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p>	<p>Short term: NAI along much of the boundary of this site will allow natural processes to operate and is likely to be beneficial to the SAC. However the continued maintenance of defences in the north-eastern part of the designated site will constrain natural processes and will result in coastal squeeze of the intertidal habitat.</p> <p>Medium term: As above</p>	<p>Short term: NAI along much of the boundary of this site will allow natural processes to operate and is likely to be beneficial to the SAC. However the continued maintenance of defences in the north-eastern part of the designated site will constrain natural processes and will result in coastal squeeze of the intertidal habitat.</p> <p>Medium term: A combination of managed realignment and no active</p>

SMP 2 Policy Scenario Area 8: Buddon Ness

Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
				<p>Long term: As above</p> <p>Potential requirement for a Habitat Regulations Assessment (HRA) under the Conservation of Habitats and Species Regulations 2010.</p>	<p>intervention in this management unit will allow natural processes to operate and is likely to be beneficial to the SAC, allowing the natural migration inland of the dune habitats.</p> <p>Long term: As above</p>
Part of Firth of Tay and Eden Estuary SPA and Ramsar site	<ul style="list-style-type: none"> Supports internationally important numbers of non-breeding waterfowl and aggregations of non-breeding birds 	To support natural coastal processes and maintain and enhance the integrity of internationally designated nature conservation sites and the favourable condition of their interest features	<p>Short term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Medium term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Long term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p>	<p>Short term: NAI along much of the boundary of this site will allow natural processes to operate and is likely to be beneficial to the SPA and Ramsar site. However the continued maintenance of defences in the north-eastern part of the designated site will constrain natural processes and will result in coastal squeeze of intertidal habitat supporting designated bird species.</p> <p>Medium term: As above</p> <p>Long term: As above</p> <p>Potential requirement for a Habitat Regulations Assessment (HRA) under the Conservation of Habitats and Species Regulations 2010.</p>	<p>Short term: NAI along much of the boundary of this site will allow natural processes to operate and is likely to be beneficial to the SPA and Ramsar site. However the continued maintenance of defences in the north-eastern part of the designated site will constrain natural processes and will result in coastal squeeze of intertidal habitat supporting designated bird species.</p> <p>Medium term: A combination of managed realignment and no active intervention in this management unit will allow natural processes to operate and is likely to be beneficial to the designated site.</p> <p>Long term: As above</p>
West part of Barry Buddon SSSI	<ul style="list-style-type: none"> Barry Links is an SSSI for its dune habitats and landforms, vascular plants, bryophytes, invertebrates and breeding birds. 	To maintain and enhance nationally designated conservation sites and their interest features	<p>Short term: Integrity of national conservation interest features maintained. Potential flood risk to freshwater habitats and species.</p> <p>Medium term: Integrity of national conservation interest features maintained. Increased flood risk to freshwater habitats and species.</p> <p>Long term: Integrity of national conservation interest features maintained. Increased flood risk to freshwater habitats and species.</p>	<p>Short term: NAI along much of the boundary of this site will allow natural processes to operate and is likely to be beneficial to the dune habitats and qualifying interest species of the SSSI. However the continued maintenance of defences in the north-eastern part of the designated site will constrain natural processes and will result in coastal squeeze of intertidal habitat supporting some qualifying interest species.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: NAI along much of the boundary of this site will allow natural processes to operate and is likely to be beneficial to the dune habitats and qualifying interest species of the SSSI. However the continued maintenance of defences in the north-eastern part of the designated site will constrain natural processes and will result in coastal squeeze of intertidal habitat supporting some qualifying interest species.</p> <p>Medium term: A combination of managed realignment and no active intervention in this management unit will allow natural processes to operate and is likely to be beneficial to the designated site.</p> <p>Long term: As above</p>
Barry Links GCR	<ul style="list-style-type: none"> Designated for Coastal geomorphology e.g. suite of parabolic dunes, elongated 'hairpin' landforms with an exceptionally consistent shape; these are among the best-preserved dunes of this type in Britain. 	To avoid adverse impacts on, conserve and enhance the designated interest of local conservation sites	<p>Short term: Integrity of local conservation interest features maintained. Dune habitats can migrate landward naturally in response to rising sea levels although there may be some erosion of the dune face and breaching of the dunes from storm surges.</p> <p>Medium term: As above</p>	<p>Short term: Holding the line at Barry Links East will prevent the natural roll-back of the dune habitats and is likely to be detrimental to the GCR.</p> <p>Further south, the dune habitats will be allowed to migrate landward naturally in response to sea level rise although there may be some erosion of the dune face and</p>	<p>Short term: Holding the line at Barry Links East will prevent the natural roll-back of the dune habitats and is likely to be detrimental to the GCR.</p> <p>Medium term: Integrity of local conservation interest features maintained by policies of managed realignment and no active intervention.</p>

SMP 2 Policy Scenario Area 8: Buddon Ness

Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
			Long term: As above	breaching of the dunes from storm surges. Medium term: As above Long term: As above	Dune habitats can migrate landward naturally in response to rising sea levels although there may be some erosion of the dune face and breaching of the dunes from storm surges. Long term: As above
Water					
Sand beach and dunes	<ul style="list-style-type: none"> Open coast and Ness system is one of the largest sites on the East coast of Scotland (1641.4 ha) extending for almost 23km. Forming a narrow belt of open dune coast for much of this distance, the site is almost 4km wide where a very large foreland system (Barry Buddon) has developed at the mouth of the River Tay. Monifieth Bay inter-tidal area stretches along the coast for almost 6km. It is preceded by narrow (200m) inter-tidal sand flat at Buddon Ness, which gains width towards Monifieth reaching a greatest width of 1km from the HWMOST. 	To maintain and enhance features as a natural flood defence	<p>Short term: Where defences remain at Barry Sand East, beaches may narrow in front of defences, reducing their function of a natural defence. Beaches and dune system at Buddon Ness will continue to provide natural protection to this stable frontage.</p> <p>Medium term: As short term</p> <p>Long term: Following failure of the defence at Barry Sands East, beaches and dune system at Buddon Ness will be able to evolve naturally providing natural protection to this frontage.</p>	<p>Short term: Where defences are maintained at Barry Sands East, beaches may narrow in front of defences, reducing their function of a natural defence. Beaches and dune system at Buddon Ness will continue to provide natural protection to this stable frontage.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Where defences are maintained at Barry Sands East, beaches may narrow in front of defences, reducing their function of a natural defence. Beaches and dune system at Buddon Ness will continue to provide natural protection to this stable frontage.</p> <p>Medium term: Managed realignment at Barry Sands East will reconnect the beach and dune system. The beaches and dunes at Buddon Ness will evolve naturally, maintaining their natural coastal defence function.</p> <p>Long term: As above.</p>
Water bodies include (but are not limited to the following): <ul style="list-style-type: none"> Carnoustie to Fife Ness Coastal Water Body (ID 200069) Lower Tay Estuary Transitional Water Body (ID 200438) Carnoustie bedrock and localised sand and gravel aquifers Ground Water Body (ID 150257) 	<ul style="list-style-type: none"> All estuaries, coastal waters and where relevant rivers, lakes and groundwater within the study area must achieve a standard of 'good status' by 2015 under the terms of the EU Water Framework Directive (WFD); whereby 'status' is a measure of ecological, chemical, hydrological and morphological quality in surface waters. 	To support the achievement of good ecological and chemical status under the EU WFD	<p>Short term: Natural processes of coastal and transitional water bodies (or any other water body) will not be constrained.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Natural processes of transitional water body will continue along Barry Sands West frontage. Natural processes of coastal water body along Barry Sands East frontage will not be constrained to any significant extent, but depends on rate of sea level rise.</p> <p>Medium term: Whilst natural processes will continue in the transitional water body at Barry Sands West, as sea levels rise with climate change, some loss of intertidal habitats is likely along the coastal water body frontage at Barry Sands East. The frontage represents >10% of the water body's coastline and the loss of habitats may impact on ecological quality.</p> <p>Long term: As above</p>	<p>Short term: Natural processes of transitional water body will continue along Barry Sands West frontage. Natural processes of coastal water body along Barry Sands East frontage will not be constrained to any significant extent, but depends on rate of sea level rise.</p> <p>Medium term: Natural processes will continue in the transitional water body at Barry Sands West, and MR on the Barry Sands East frontage will sustain intertidal habitats in the coastal water body frontage at Barry Sands East, in line with WFD objectives.</p> <p>Long term: As above</p>
Landscape					
Barry sands west, a continuation of the beach at Buddon Ness Monifieth Bay	<ul style="list-style-type: none"> Barry Sands and Monifieth Bay are important elements contributing to the landscape character of this CPU. 	To enhance the aesthetic value and landscape character of the coastline	<p>Short term: Allowing natural processes will maintain the landscape character at Buddon Ness.</p> <p>Medium term: Allowing natural processes will maintain the landscape character at Buddon Ness.</p> <p>Long term: Allowing natural processes will</p>	<p>Short term: Allowing natural processes will maintain the landscape character at Buddon Ness. Holding the line at Barry Sands East will result in the continued narrowing of the beach and loss of the dunes with potential changes in landscape character. At Barry Sands East, the natural interaction between the beach and dune habitats will be</p>	<p>Short term: Allowing natural processes will maintain the landscape character at Buddon Ness. Holding the line at Barry Sands East will result in the continued narrowing of the beach and loss of the dunes with potential changes in landscape character. At Barry Sands East, the natural interaction between the</p>

SMP 2 Policy Scenario Area 8: Buddon Ness					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	Scenario B
			maintain the landscape character of Buddon Ness.	prevented. Medium term: As above Long term: As above	beach and dune habitats will be prevented. Medium term: Managed realignment at Barry Sands East will change the landscape in this location. However, allowing natural processes will mean a more natural landscape to evolve. Long term: As above

The accompanying shoreline interaction and response appraisal for Scenario Area 8 – Buddon Ness is included in **Section G2.8 Buddon Ness**

G3.9 Monifieth to Broughty Ferry

Table G3.17 Monifieth to Broughty Ferry alternative policies to test

SMP 2 Policy Scenario Area 9: Monifieth to Broughty Ferry						
SMP 2 Management Units	Policies to test – Scenario A			Policies to test – Scenario B		
	0-20 yrs	20-50 yrs	50-100 yrs	0-20 yrs	20-50 yrs	50-100 yrs
MU 9/1 MoD Boundary to west Tayview Caravan Park	HTL	HTL	HTL			
MU 9/2 Monifieth West	HTL	HTL	HTL			
MU 9/3 Barnhill to the Esplanade	HTL	HTL	HTL			
MU 9/4 Broughty Ferry East	HTL	HTL	HTL			
MU 9/5 Broughty Ferry	HTL	HTL	HTL			

Key: hold the line (HTL)

Table G3.18 Monifieth to Broughty Ferry alternative policy scenarios objective appraisal

SMP 2 Policy Scenario Area 9: Monifieth to Broughty Ferry					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	
Population and human health					
Residential	<ul style="list-style-type: none"> Towns of Monifieth and Broughty Ferry 	To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans	<p>Short term: Defences remain providing flood and erosion protection to Monifieth and Broughty Ferry.</p> <p>Medium term: There will be risk of flooding and erosion to parts of Monifieth and Broughty Ferry as defences fail.</p> <p>Long term: There will be increased risk of flooding and erosion to Monifieth and Broughty Ferry following defence failure.</p>	<p>Short term: Continued flood protection to Monifieth and Broughty Ferry.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Designated bathing beach	<ul style="list-style-type: none"> EC Designated Bathing Water Results (SEPA) designated Monifieth and Broughty Ferry as excellent classification in 2011. Broughty Ferry beach achieved Blue Flag status in 2004; an Internationally recognised symbol of a well managed beach where water quality meets the maximum legal EU standards and sound environmental management of the beach is promoted. 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Where defences remain, beaches may narrow in front of defences, reducing amenity value, however, accretion in front of some defences at Monifieth playing fields and at Broughty Ferry is expected to continue.</p> <p>Medium term: Where defences remain, beaches may narrow in front of defences, reducing their amenity value, accretion in front of some defences at Monifieth playing fields and at Broughty Ferry is expected to continue. Potential loss of beach access points.</p> <p>Long term: Where infrastructure or defences restrict movement beaches will narrow and dune erosion will increase, reducing amenity value. Potential loss of beach access points.</p>	<p>Short term: Beaches will narrow in front of defences, reducing the amenity value of the beach, however, accretion in front of some defences at Monifieth playing fields and at Broughty Ferry is expected to continue.</p> <p>Medium term: Beaches will narrow in front of defences, reducing their amenity value, accretion in front of some defences at Monifieth playing fields and at Broughty Ferry is expected to continue.</p> <p>Long term: Continued maintenance and upgrading of the existing defences will restrict movement, beaches will narrow and dune erosion will increase, reducing amenity value. Potential loss of beach access points.</p>	
Informal recreational assets	<ul style="list-style-type: none"> Coastal walks at Shoreline Monifieth and broughty Ferry 	To minimise coastal flooding and erosion risk to key recreation and tourism assets	<p>Short term: No adverse impacts where defences remain. Flood and erosion risk to informal recreation assets where defences have</p>	<p>Short term: Continued flood and erosion protection of most informal recreational assets although the coastal</p>	

SMP 2 Policy Scenario Area 9: Monifieth to Broughty Ferry

Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A
	<ul style="list-style-type: none"> Broughty is popular for its water sports including several motorised activities Coastal foot/cycle access runs from the edge of the Riverview playing fields to the start of Tayview Caravan Park and from the western edge of Tayview Caravan Park to Broughty Ferry castle and beyond 	<p>and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>failed in the short term around Dighty Water.</p> <p>Medium term: Flood and erosion risk to recreation assets following defence failure.</p> <p>Long term: Increased flood and erosion risk to recreation assets following defence failure.</p>	<p>footpath may be subject to erosion or flooding in some locations. There are opportunities to improve recreational assess, features and aesthetics of existing defence in this management unit.</p> <p>Medium term: Continued flood and erosion protection of most informal recreational assets although the coastal footpath may be need to be relocated landward in some locations between Monifieth and Broughty Ferry. There are opportunities to improve recreational assess, features and aesthetics of existing defence in this management unit.</p> <p>Long term: As above</p>
Monifieth Seafront Recreation Area (putting green, tennis courts, football pitches)	<ul style="list-style-type: none"> Includes a skate park, play areas for toddlers and teenagers, putting, lookout tower, path network, improved toilet facilities, increased parking and traffic calming. 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Defences remain in the short term providing flood / erosion protection to the recreation area.</p> <p>Medium term: Defences remain and dunes will continue to front the football pitches providing flood / erosion protection. Failure of defences at the Monifieth recreation area will result in erosion / flood risk to the site.</p> <p>Long term: Increased flood / erosion risk to recreation areas at Monifieth.</p>	<p>Short term: Continued flood and erosion protection of Monifieth Seafront recreational assets.</p> <p>Medium term: As above</p> <p>Long term: As above</p>
Broughty Ferry Castle, putting green, pavilion	<ul style="list-style-type: none"> Broughty Ferry links offer several leisure facilities including tennis courts and putting. 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Defences remain, providing protection to the castle.</p> <p>Medium term: Defences remain, providing protection to the castle.</p> <p>Long term: Flood risk to the castle if defences fail.</p>	<p>Short term: Continued flood and erosion protection of Broughty Ferry Castle.</p> <p>Medium term: As above</p> <p>Long term: As above.</p>
Caravan parks	<ul style="list-style-type: none"> Monifieth Bay is home to two camping and caravan sites, Riverview and Tayview Caravan Parks. Both sites are busy throughout the holiday seasons providing facilities for year round static caravans as well as touring caravans. 	<p>To minimise coastal flooding and erosion risk to key recreation and tourism assets and activities</p> <p>To enhance the tourism value of the coast and aim to incorporate and improve recreation, tourism and visitor management</p>	<p>Short term: Defences remain in the short term providing flood / erosion protection to the Caravan Parks</p> <p>Medium term: Riverside Caravan Park defences remain providing flood / erosion protection. Failure of defences at Tayview Caravan Park will result in erosion / flood risk to the site.</p> <p>Long term: Increased flood / erosion risk to both caravan parks.</p>	<p>Short term: Continued flood and erosion protection to Caravan Parks.</p> <p>Medium term: As above</p> <p>Long term: As above.</p>
Historic landfill site at Monifieth and Broughty Ferry	<ul style="list-style-type: none"> The recreational facilities at Monifieth Bay have been constructed on an existing landfill site, which was in operation between 1920 and 1930. The dune slacks at Monifieth Bay were also used as landfill sites and capped 	<p>To minimise coastal flooding and erosion risk and its impact on people, coastal land use and future development plans.</p>	<p>Short term: Defences remain in the short term providing flood / erosion protection to the historic landfill area.</p> <p>Medium term: Defences remain and dunes will continue to front the historic landfill area providing flood / erosion protection. Failure of</p>	<p>Short term: Continued flood and erosion protection to the historic landfill area.</p> <p>Medium term: As above</p> <p>Long term: As above</p>

SMP 2 Policy Scenario Area 9: Monifieth to Broughty Ferry					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	
	with soil.		defences will result in erosion / flood risk to the site and potential release of contaminants. Long term: Increased flood / erosion risk to the historic landfill site and increased risk of release of contaminants.		
Material Assets and Infrastructure					
Access to Port of Dundee	<ul style="list-style-type: none"> Access to port to be maintained 	To minimise the impact of policies on marine operations and activities	Short term: No adverse impacts Medium term: No adverse impacts Long term: No adverse impacts	Short term: No adverse impacts Medium term: No adverse impacts Long term: No adverse impacts	
Water main, sewage outfalls and pipelines	<ul style="list-style-type: none"> Marine Avenue, Monifieth (Combined storm outfall) Grange Road, Monifieth (Combined storm outfall) Dighty Burn, Monifieth (Short Sea) South Balmossie, Monifieth (Long Sea) Broughty Castle, Broughty Ferry (Short Sea) British Gas national pipeline 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	Short term: Potential risk of flooding/erosion to service infrastructure. Medium term: Increasing risk of flooding/erosion to service infrastructure. Long term: As above	Short term: Continued flood and erosion protection to service infrastructure. Medium term: As above Long term: As above.	
Minor roads	<ul style="list-style-type: none"> Local roads provide access to settlements and some other locations along the coastline. 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	Short term: Potential flood risk to minor roads. Medium term: Potential flood risk to minor roads increases with sea level rise. Long term: Potential flood risk to minor roads continues to increase with increased sea level rise.	Short term: Continued flood protection to minor roads. Medium term: As above Long term: As above.	
Main East Coast Railway	<ul style="list-style-type: none"> The main East Coast Railway Line runs very close to the coast along part of the unit. 	To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services	Short term: Potential erosion risk to the railway west of Dighty Water following defence failure. Medium term: Increased erosion risk to the railway following defence failure east of Dighty Water. Long term: Increased erosion and flood risk to the East Coast Mainline	Short term: Continued erosion protection to Main East Coast Railway. Medium term: As above Long term: As above.	
Historic Environment					
Broughty Ferry Conservation area	<ul style="list-style-type: none"> An area of special architectural and historic interest. Need to ensure that proposals do not affect the preservation or enhancement of the established character and appearance. 	To minimise coastal flood and erosion risk to scheduled and other nationally, regionally or locally important archaeological and cultural heritage assets, sites and their setting.	Short term: No adverse impacts. Medium term: Potential for deterioration of established character and appearance as seawall deteriorates. Long term: Deterioration of established character and appearance following failure of seawall.	Short term: Continued flood protection of architectural and historic assets in the Conservation Area. Medium term: As above Long term: As above.	
Broughty Castle	<ul style="list-style-type: none"> Broughty Castle was built in 1496 and allowed to fall into decay after 1603. 	To minimise coastal flood and erosion risk to scheduled and other nationally,	Short term: Defences remain, providing	Short term: Continued flood and erosion protection of Broughty Ferry	

SMP 2 Policy Scenario Area 9: Monifieth to Broughty Ferry					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	
	<p>The castle was reconstructed and extended following purchase by the government in 1855. It has now been completely restored and operates as a museum</p> <ul style="list-style-type: none"> Scheduled Monument A-Listed Building 	regionally or locally important archaeological and cultural heritage assets, sites and their setting.	<p>protection to the castle.</p> <p>Medium Term: Defences remain, providing protection to the castle.</p> <p>Long term: Flood risk to the castle if defences fail.</p>	Castle.	<p>Medium term: As above</p> <p>Long term: As above.</p>
Flora, fauna and biodiversity					
Part of Firth of Tay and Eden Estuary cSAC	<ul style="list-style-type: none"> Coastal dune heathland Shifting dunes Dune grassland Humid dune slacks Shifting dunes with marram 	To support natural coastal processes and maintain and enhance the integrity of internationally designated nature conservation sites and the favourable condition of their interest features	<p>Short term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Medium term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Long term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p>	<p>Short term: The continued maintenance of defences will constrain natural migration landward of the dune habitats and will result in coastal squeeze of the intertidal habitat due to rising sea levels.</p> <p>Medium term: As above</p> <p>Long term: As above</p> <p>Potential requirement for a Habitat Regulations Assessment (HRA) under the Conservation of Habitats and Species Regulations 2010.</p>	
Part of Firth of Tay and Eden Estuary SPA and Ramsar site	<ul style="list-style-type: none"> Supports internationally important numbers of non-breeding waterfowl and aggregations of non-breeding birds 	To support natural coastal processes and maintain and enhance the integrity of internationally designated nature conservation sites and the favourable condition of their interest features	<p>Short term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Medium term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p> <p>Long term: Natural coastal processes will not be constrained. Integrity of international conservation interest features maintained.</p>	<p>Short term: The continued maintenance of defences will constrain natural processes and will result in coastal squeeze of intertidal habitat supporting designated bird species.</p> <p>Medium term: As above</p> <p>Long term: As above</p> <p>Potential requirement for a Habitat Regulations Assessment (HRA) under the Conservation of Habitats and Species Regulations 2010.</p>	
Monifieth Bay SSSI	<ul style="list-style-type: none"> Inter-tidal habitat and feeding area for internationally important numbers of wintering waders and ducks. 	To maintain and enhance nationally designated conservation sites and their interest features	<p>Short term: Integrity of national conservation interest features maintained by natural processes.</p> <p>Medium term: Integrity of national conservation interest features maintained by natural processes. Potential for coastal squeeze of intertidal habitats due to sea level rise, where intertidal habitats are constrained from inland migration by existing infrastructure e.g. The Esplanade and Marine Drive etc</p> <p>Long term: Potential for coastal squeeze of intertidal habitats due to sea level rise, where intertidal habitats are constrained from inland migration by existing infrastructure e.g. The Esplanade and Marine Drive etc</p>	<p>Short term: The continued maintenance of defences will constrain natural processes and will result in coastal squeeze of intertidal habitat supporting designated bird species.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	
Water					

SMP 2 Policy Scenario Area 9: Monifieth to Broughty Ferry					
Location / Feature	Key Issues and Benefits	Objectives	No Active Intervention	Scenario A	
Sand beach and dunes	<ul style="list-style-type: none"> Monifieth Bay inter-tidal area stretches along the coast for almost 6km. It is preceded by narrow (200m) inter-tidal sand flat at Buddon Ness, which gains width towards Monifieth reaching a greatest width of 1km from the HWMOST. 	To maintain and enhance features as a natural flood defence	<p>Short term: Where defences remain, beaches may narrow in front of defences, reducing their function of a natural defence, however, accretion in front of defences at Monifieth playing fields and at Broughty Ferry is expected to continue.</p> <p>Medium term: As short term</p> <p>Long term: Where infrastructure or defences restrict movement beaches will narrow and dune erosion will increase. Following failure of the defences east of Dighty Water the beach will continue to narrow and lower as sea levels rise due to coastal squeeze against the railway line.</p>	<p>Short term: Beaches may narrow in front of defences, reducing their function of a natural defence, however, accretion in front of defences at Monifieth playing fields and at Broughty Ferry is expected to continue.</p> <p>Medium term: As short term</p> <p>Long term: Defences will continue to restrict movement, beaches will narrow and dune erosion will increase.</p>	
Water bodies include (but are not limited to) the following: <ul style="list-style-type: none"> Lower Tay Estuary Transitional Water Body (ID 200438) Dighty Water River Water Body (ID 6001) Dundee bedrock and localised sand and gravel aquifers Ground Water Body (ID 150256) 	<ul style="list-style-type: none"> All estuaries, coastal waters and where relevant rivers, lakes and groundwater within the study area must achieve a standard of 'good status' by 2015 under the terms of the EU Water Framework Directive (WFD); whereby 'status' is a measure of ecological, chemical, hydrological and morphological quality in surface waters. 	To support the achievement of good ecological and chemical status under the EU WFD	<p>Short term: Natural processes of transitional water body (and any other water bodies) will not be constrained.</p> <p>Medium term: As above</p> <p>Long term: As above</p>	<p>Short term: Natural processes of transitional water body will not be constrained to any significant extent, but depends on rate of sea level rise.</p> <p>Medium term: As sea levels rise with climate change, some loss of intertidal beach habitats is likely along approximately half of the transitional water body frontage (whilst accretion is expected to continue along the other half). This "squeezed" frontage represents approximately 5% of the water body's coastline, and although other reaches will have significantly higher ecological value to the water body as a whole, there may be some impact on ecological quality.</p> <p>Long term: As above plus dune loss is likely to accompany beach loss.</p>	
Landscape					
<p>Monifieth recreation ground and caravan parks</p> <p>The Dighty Water splits Monifieth Beach from the beach that runs west to Broughty Ferry.</p> <p>Links area at Broughty Ferry</p> <p>Broughty Ferry town and Castle fronted by a wide sandy beach</p>	<ul style="list-style-type: none"> Barry Sands and Monifieth Bay are important elements contributing to the landscape character of this CPU. 	To enhance the aesthetic value and landscape character of the coastline	<p>Short term: Failing defences may impact on the landscape at Monifieth.</p> <p>Medium term: Failure of defences may impact on the landscape at Monifieth and Broughty Ferry.</p> <p>Long term: Potential impacts on landscape associated with defence failure; however the frontage will start to evolve to a more natural landscape over time.</p>	<p>Short term: Defence maintenance will maintain the existing landscape character of the frontage</p> <p>Medium term: Over time, the defences will result in the narrowing of the beach, which may change the local landscape character, reducing the current expanse of sandy beach at low water.</p> <p>Long term: As above</p>	

The accompanying shoreline interaction and response appraisal for Scenario Area 9 – Monifieth to Broughty Ferry is included in Section **G2.9 Monifieth to Broughty Ferry**

G4 Proposed Preferred Policies

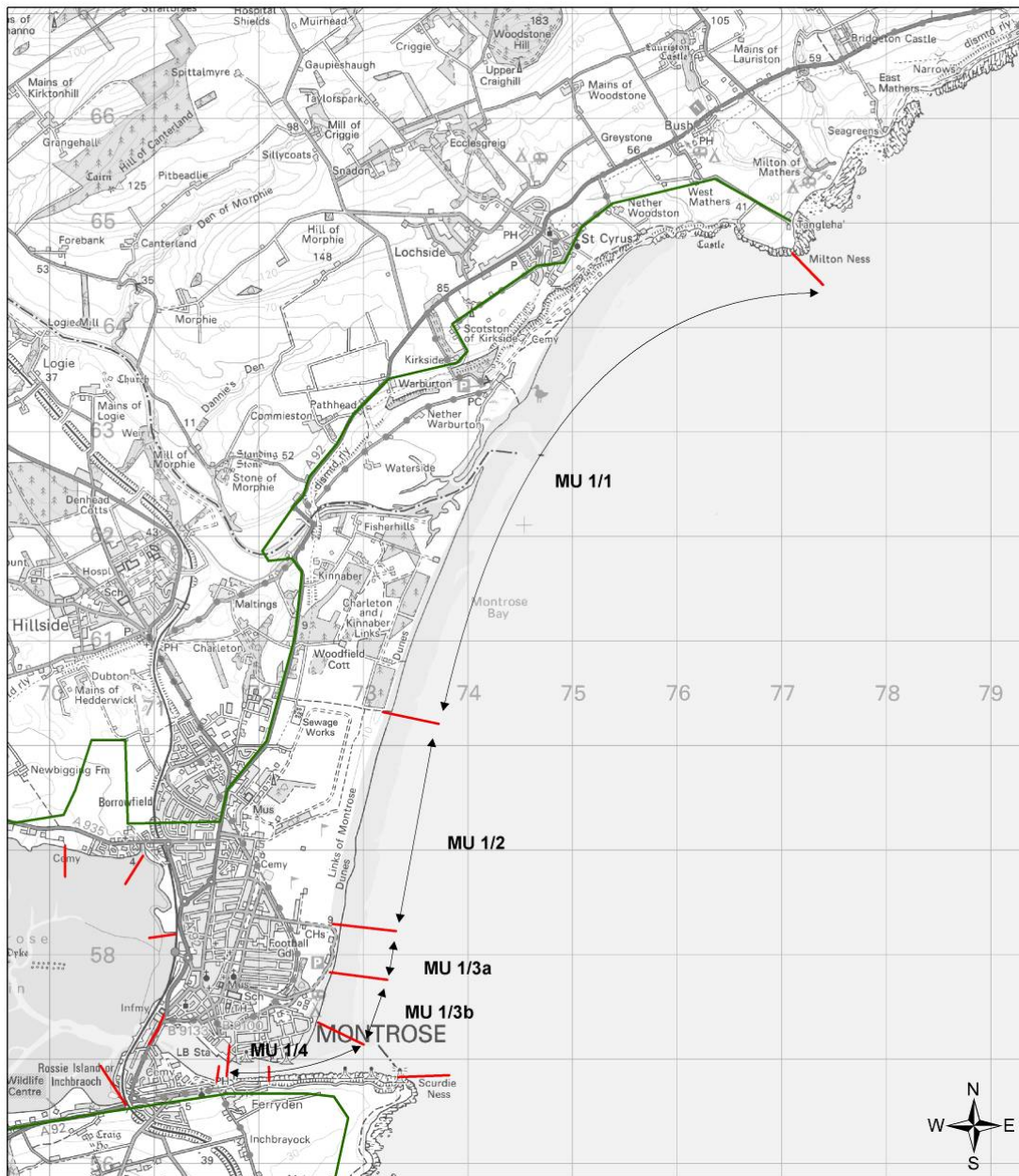
The side by side assessments of shoreline interaction and responses and achievement of objectives (Sections G2 and G3) along with preliminary assessments of no active intervention damages and estimates of costs for options (**Appendix H**), the Strategic Environmental Assessment (SEA) (**Appendix D**), Habitats Regulations Assessment (HRA) (**Appendix I**) and Water Framework Directive (WFD) (**Appendix J**) assessment were considered together to develop a preliminary draft set of proposed preferred policies.

An holistic approach was adopted by looking at the effects of each policy scenario on localised shoreline evolution, interactions with adjacent shorelines, effects on features, achievement of objectives and preliminary economics for each scenario, in combination, to formulate a set of 'socially, environmentally and economically' acceptable policy scenarios for the SMP 2.

The resulting preliminary draft proposed preferred policies (Sections G4.1 to G4.9) and revised management units were put forward to the Client Steering Group (CSG) for discussion at CSG meeting 3. Where these policies have changed from SMP 1 a brief summary of the rationale behind the selection has also been given. The revised SMP 2 Management Unit Boundaries are shown in Figures G4.1 to G4.6.

Minutes from the meeting are included with other stakeholder engagement material in **Appendix B**.

The outcome of discussions at the CSG 3 meeting resulted in the refinement of preferred policies in a small number of locations (see Section G.5) and ultimately, the identification of a set of agreed preferred policies for the SMP 2 frontage (Table G5.1). Further discussion with SNH subsequently resulted in the revision of MU2/4, into 3 separate units (See Section G.5).



Project:
Angus Shoreline Management
Plan 2

Drawing:
SMP2 - Revised Management Units
(Map 1/6)

Angus Council **Halcrow**
A CH2M HILL COMPANY

Drawn By: CD 02/08/2012
Checked By: MC 02/08/2012
Approved By: SB 02/08/2012

0 0.25 0.5 1
Kilometres

Drawing Scale: 1:35,000
Plot Scale: 1:35,000 @ A3

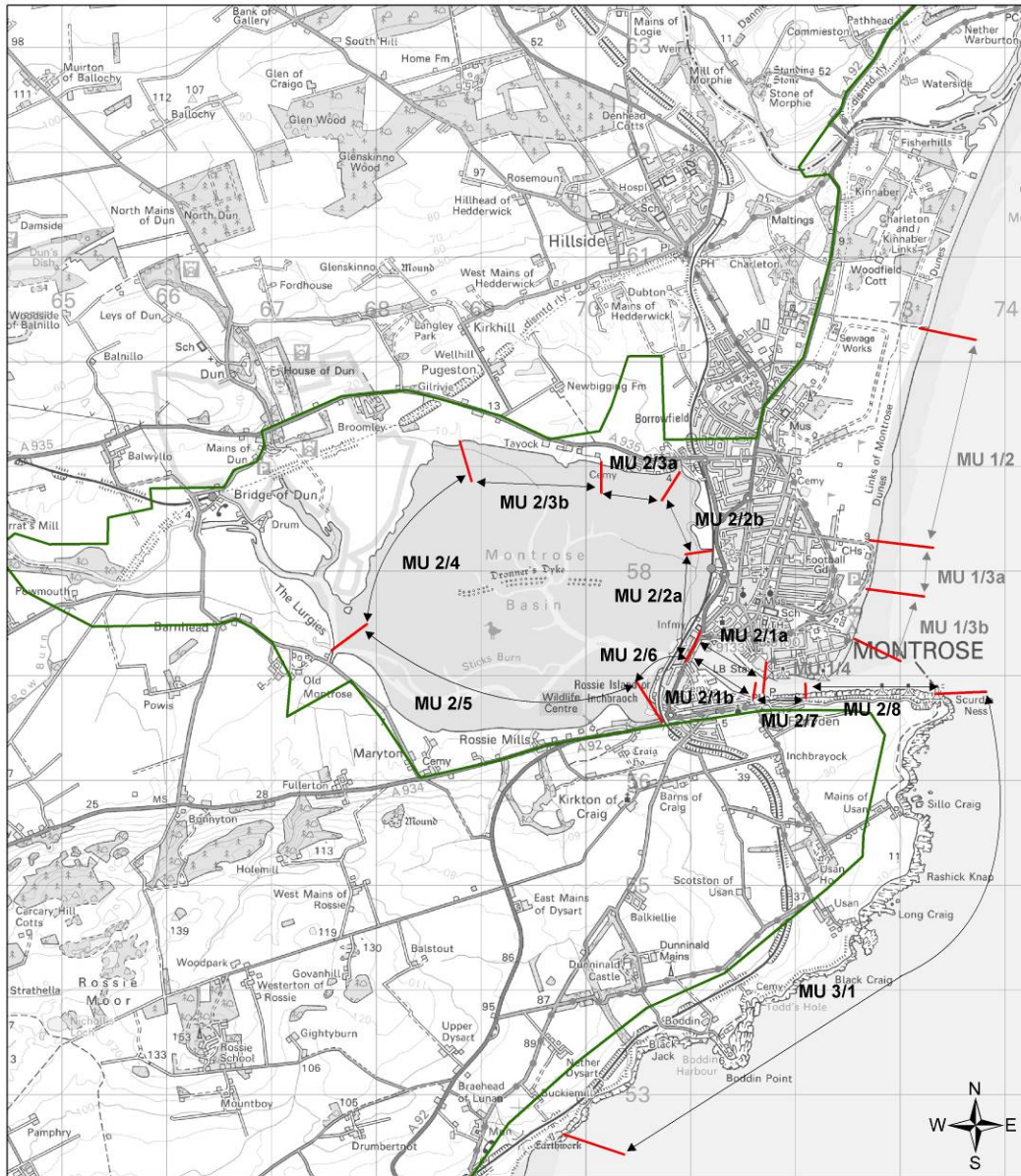
Legend

- Management Unit (MU)
- Landward Boundary

Location Plan:

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Figure G4.1 Revised SMP 2 Management Unit boundaries – Montrose




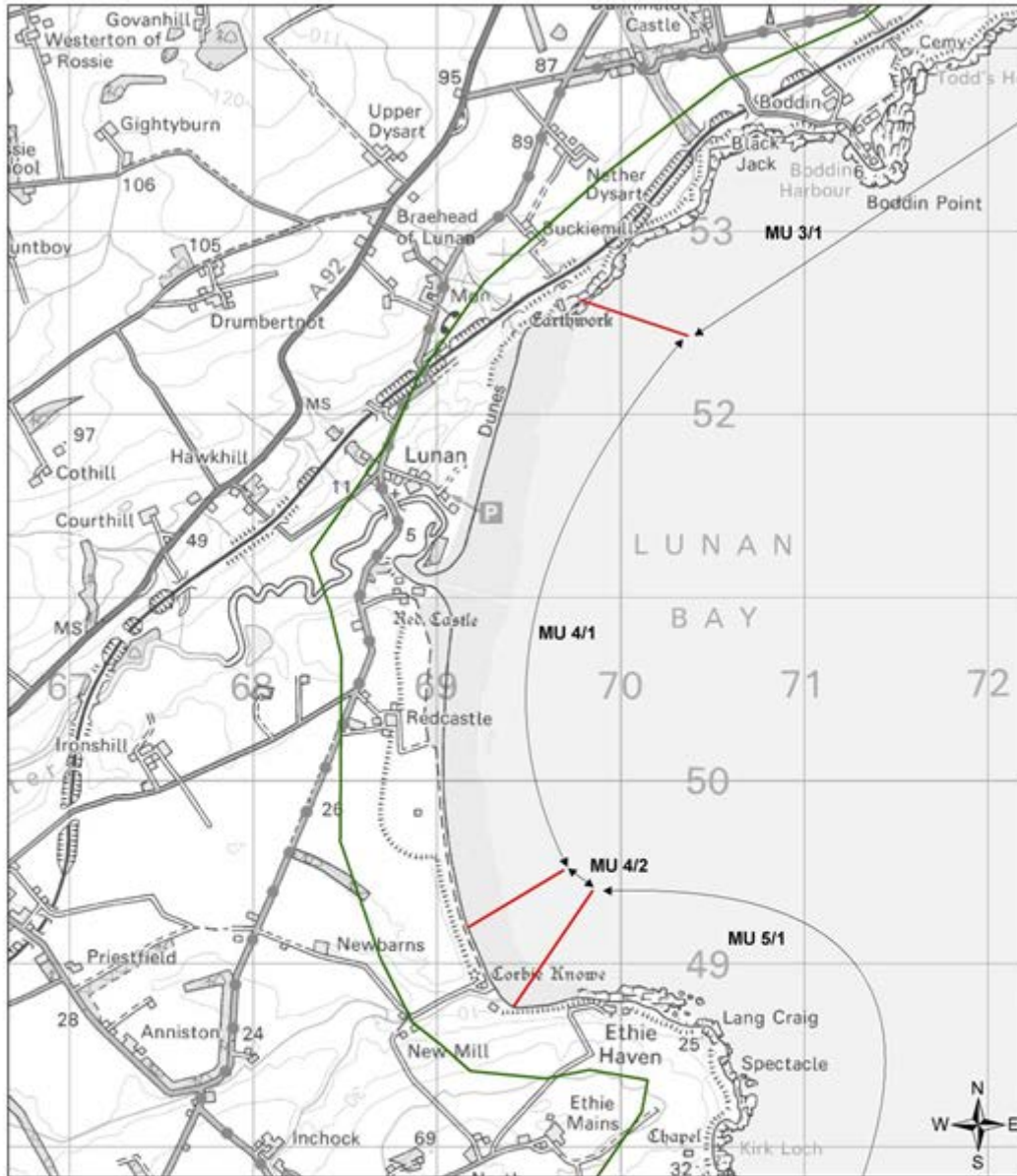
<p>Project : Angus Shoreline Management Plan 2 Drawing : SMP2 - Revised Management Units (Map 2/6)</p> <p>Angus Council Halcrow A CH2M HILL COMPANY</p> <p>Drawn By : TC 02/08/2012 Checked By : MC 02/08/2012 Approved By : SB 02/08/2012</p> <p>Drawing Scale : 1:35,000 Plot Scale : 1:35,000 @ A3</p>	<p>Legend</p> <p>— Management Unit (MU)</p> <p>— Landward Boundary</p>	<p>Location Plan:</p>  <p>This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. 100023404 (c)12</p>
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Figure G4.2 Revised SMP 2 Management Unit boundaries – Montrose Basin and Surdie Ness to Rickle Craig



<p>Project Angus Shoreline Management Plan 2 Drawing: SMP2 - Revised Management Units (Map 3/6)</p> <p>Angus Council Halcrow A BDM WIL COMPANY</p> <p>Drawn By: TC 02/08/2012 Checked By: MC 02/08/2012 Approved By: SB 02/08/2012</p> <p>Drawing Scale: 1:20,000 Plot Scale: 1:20,000 @ A3</p>	<p>Legend</p> <ul style="list-style-type: none"> — Management Unit (MU) — Landward Boundary 	<p>Location Plan:</p>  <p><small>This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. 10003404 (2012)</small></p>
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Figure G4.3 Revised SMP 2 Management Unit boundaries – Lunan Bay



Project :
Anguilla Shoreline Management
Plan 2
Drawing :
SMP2 - Revised Management Units
(Map 4/5)

Anguilla Council
Halcrow
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Drawn By : TC 02/08/2012
Checked By : MC 02/08/2012
Approved By : SB 02/08/2012

Drawing Scale : 1:30,000
Plot Scale : 1:30,000 @ A3

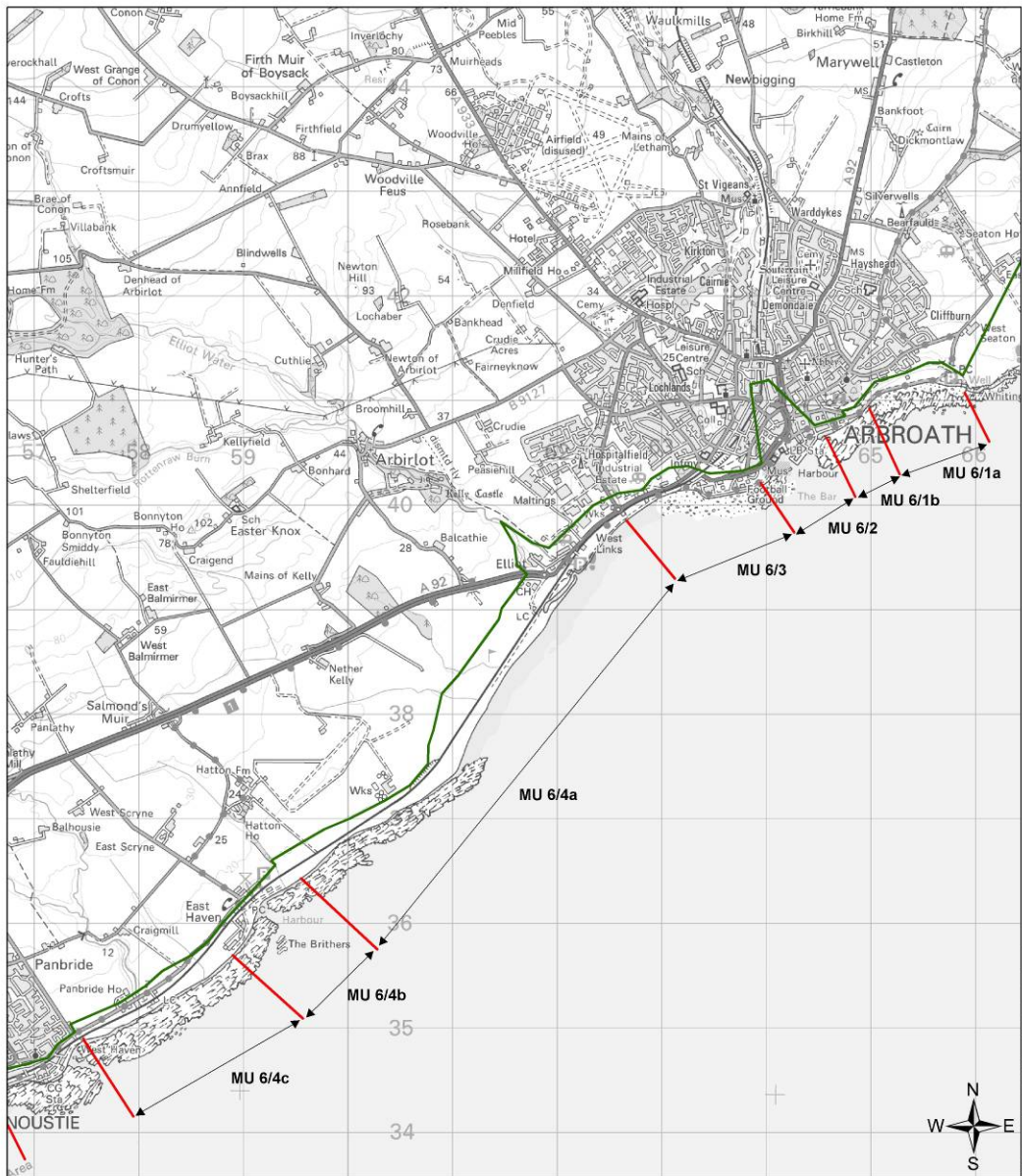
Legend

- Management Unit (MU)
- Landward Boundary

Location Plan

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Figure G4.4 Revised SMP 2 Management Unit boundaries – Lang Craig to Whiting Ness



Project :
Angus Shoreline Management
Plan 2
Drawing :
SMP2 - Revised Management Units
(Map 5/6)

Angus Council **Halcrow**
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Drawn By : TC 02/08/2012
Checked By : MC 02/08/2012
Approved By : SB 02/08/2012

Kilometres
0 0.25 0.5 1

Drawing Scale : 1:35,000
Plot Scale : 1:35,000 @ A3

Legend

- Management Unit (MU)
- Landward Boundary

Location Plan:

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Figure G4.5 Revised SMP 2 Management Unit boundaries – Arbroath to West Haven

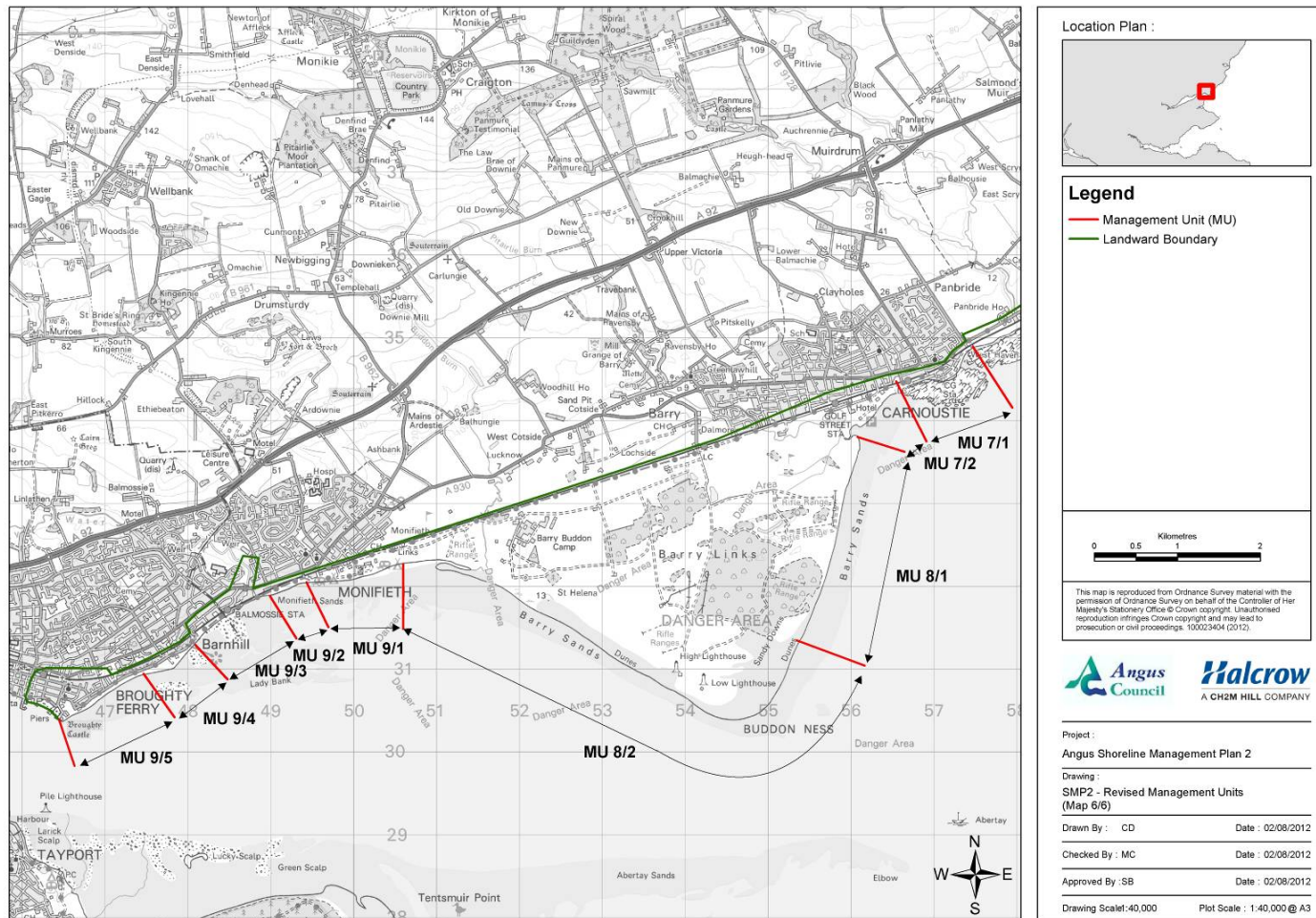


Figure G4.6 Revised SMP 2 Management Unit boundaries – Carnoustie, Buddon Ness and Monifieth to Broughty Ferry

G4.1 Scenario Area 1 - Montrose

Table G4.1 Draft recommended preferred policies and revised management units for CSG 3 discussion - Montrose

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
MU 1/1 Montrose Bay (Milton Ness to Montrose Links)	NAI	NAI	NAI	No justification to change from current policy
MU 1/2 Montrose Golf Links	MR	MR	MR	
MU 1/3 (a) Splash (The Faulds)	HTL	HTL	MR or HTL	<p>HTL, HTL, MR: Under rising sea levels coastal squeeze may result in loss of beaches in front of the Splash / Holiday Park frontage and therefore, holding defences on their current alignment will become unsustainable in the long term. In the short and medium term, maintenance of existing defences will reduce flood and erosion risk to the Splash recreation area and South Links Holiday Park, however, overtopping of these defences will become more of an issue over time. There is an opportunity for beneficial use of River South Esk dredgings as recharge material along the frontage as part of the scheme to help maintain beach levels, assuming material is suitable and available (in line with the Montrose Erosion study by Milne and Dong, 2011). Holding the line into the medium term will allow time for relocation of assets. In the long term, removal of defences will allow a more natural shoreline alignment to form, whilst providing a release of sediment back into the system to feed beaches and to reinstate the dunes as a natural line of defence.</p> <p>HTL, HTL, HTL: Hold the line for all three epochs if there is a requirement from Angus Council to continue to protect Traill Drive into the long term. There is an opportunity for beneficial use of River South Esk dredgings as recharge material along the frontage as part of the scheme to help maintain beach levels, assuming material is suitable and available (in line with the Montrose Erosion study by Milne and Dong, 2011). More substantial defences will be required in the long term to address overtopping issues.</p>
MU 1/3 (b) South Links Holiday Park	HTL	HTL	MR or HTL	
MU 1/4	HTL	HTL	HTL	No justification to change from current policy

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
GlaxoSmithKline				

G4.2 Scenario Area 2 – Montrose Basin

Table G4.2 Draft recommended preferred policies and revised management units for CSG 3 discussion - Montrose Basin

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
MU 2/1 (a) Montrose Port (north bank – Glaxo to A92 bridge)	HTL	HTL	HTL	No justification to change from current policy
MU 2/1 (b) Montrose Port (south bank –A92 bridge to Ferryden)	HTL	HTL	HTL	
MU 2/2 (a) Montrose West (A92 Bridge to the end of railway defences)	HTL	HTL	HTL	
MU 2/2 (b) Montrose West (Railway defences to Tayock River)	HTL	HTL	HTL	
MU 2/3 (a) Tayock (Tayock village)	HTL	HTL	HTL	
MU 2/3 (b)	HTL	HTL	HTL	

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
Tayock (Sleepyhillock Cemetery)				Council for planning purposes. Defences along the Sleepyhillock Cemetery frontage currently reduce erosion risk to the cemetery. It has been understood that these defences are privately owned and maintained and that this policy would involve only limited intervention and private maintenance of defences. There would not be economic justification to use public funding to hold the line in this location. Holding this relatively short length of defence in the future is unlikely to have any significant affect on coastal processes within the Basin. Coastal squeeze may occur in the future; however, vertical accretion of intertidal habitats is expected to keep pace with sea level rise.
MU 2/4 West Montrose Basin (west of Tayock to Old Montrose)	MR	MR	MR	MR, MR, MR: Manage flood risk by maintaining existing defences to an adequate standard in the immediate term, while undertaking studies to investigate Managed Realignment opportunities for habitat creation. Construct a new set back defence where required and maintain these new defences to ensure that the risk of flooding is managed into the long term. Managed realignment of previously reclaimed land would provide accommodation space for habitat creation. New habitat formed may offset losses of habitat as a result of coastal squeeze elsewhere in the Basin.
MU 2/5 Old Montrose to Railway Bridge	NAI	NAI	NAI	No justification to change from current policy
MU 2/6 Rossie Island to A92	HTL	HTL	HTL	
MU 2/7 Ferryden	HTL	HTL	HTL	
MU 2/8 Ferryden to Scurdie Ness	NAI	NAI	NAI	

G4.3 Scenario Area 3 – Scurdie Ness to Rickle Craig

Table G4.3 Draft recommended preferred policies and revised management units for CSG 3 discussion – Scurdie Ness to Rickle Craig

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
MU 3/1 Scurdie Ness to Rickle Craig	NAI	NAI	NAI	No justification to change from current policy.

G4.4 Scenario Area 4 – Lunan Bay

Table G4.4 Draft recommended preferred policies and revised management units for CSG 3 discussion – Lunan Bay

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
MU 4/1 Lunan Bay	NAI	NAI	NAI	No justification to change from current policy
MU 4/2 Corbie Knowe	HTL	NAI	NAI	HTL, NAI, NAI: Ad hoc private defences along the Corbie Knowe frontage currently reduce erosion risk to the small number of holiday homes in this location. A policy of hold the line in the short term would involve private maintenance of defences until the end of their residual lives, on the understanding that no new defences would be constructed. There would not be economic justification to use public funding to hold the line in this location. Holding this short length of defence in the short term is unlikely to have any significant affect on coastal processes within Lunan Bay as a whole. This policy would allow time to relocate the assets away from the erosion risk area before defences; however, holding defences on their current alignment will become unsustainable in the medium term.

G4.5 Scenario Area 5 – Lang Craig to Whiting Ness

Table G4.5 Draft recommended preferred policies and revised management units for CSG 3 discussion – Lang Craig to Whiting Ness

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
MU 5/1 Lang Craig to Whiting Ness	NAI	NAI	NAI	No justification to change from current policy

G4.6 Scenario Area 6 – Arbroath to West Haven

Table G4.6 Draft recommended preferred policies and revised management units for CSG 3 discussion – Arbroath to West Haven

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	20-50 yrs	20-50 yrs	20-50 yrs	
MU 6/1 (a) Victoria Park	HTL	HTL	HTL	<p>HTL, HTL, HTL: Manage flood and erosion risk to the Victoria Park frontage by maintaining and upgrading existing defences, when required, to an adequate standard. Managed realignment was discounted on a number of grounds due to:</p> <ul style="list-style-type: none"> • loss of the recreation area; • A new beach could be created as the raised beach erodes, but uncertainty of material stored in the raised beach, and therefore composition of the new beach; • Released material will not be transported to other frontages, therefore only benefits will be to this frontage; • Potential requirement to construct setback defences in the longer term to provide protection to Arbroath as the hinterland erodes.
MU 6/1 (b) Seagate	HTL	HTL	HTL	No justification to change from current policy
MU 6/2 Arbroath Harbour	HTL	HTL	HTL	

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	20-50 yrs	20-50 yrs	20-50 yrs	
MU 6/3 Inchcape Park to Westway Road	HTL	HTL	HTL	
MU 6/4 (a) West Links to East Haven	HTL	HTL	HTL	HTL, HTL, HTL: A localised hold the line policy along this frontage is assumed to involve monitoring of risk and maintenance of existing defences at Dowrie, and monitoring, upgrading and maintenance of defences at Hatton in front of the railway, to maintain standards of protection to the contaminated land and infrastructure. Holding the line at these two locations is not expected to have a significant adverse effect on coastal processes, due to the short lengths of defences, however there is potential for a slight promontory to form at Dowrie. This policy should also make clear that Network Rail and Angus Council should continue to work together to continue to review the sustainability of the railway line in its present location over time.
MU 6/4 (b) East Haven	NAI	NAI	NAI	NAI, NAI, NAI: In order to continue to allow the coast to evolve naturally between Hatton and West Haven, no active intervention has been recommended at East Haven. Coastal flood and erosion risk would however need to be monitored at East Haven and adaptation measures, such as relocating paths and car parks, implementing flood warning schemes and evacuation plans, should be put in place to address increased future risk. Homeowners should also be informed about flood resistance and resilience measures they could implement within their properties. As sea levels rise, the influence of the rock platforms may reduce for longer periods of time as it becomes submerged. Consequently, a slight increase in mean water levels may result in greater wave energy reaching the beach which could lead to a greater rate of longshore transport of sand along the sections fronted by the rock platform. In effect this could act to 'smooth out' or reduce lateral variations in beach planshape that have occurred due to variations in the elevation of the rock platform along the coast. This could result in future accretion at East and West Haven.
MU 6/4 (c) East Haven to West haven	NAI	NAI	NAI	No justification to change from current policy

G4.7 Scenario Area 7 – Carnoustie

Table G4.7 Draft recommended preferred policies and revised management units for CSG 3 discussion – Carnoustie

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
MU 7/1 West Haven to Carnoustie Station	HTL	HTL	HTL	No justification to change from current policy
MU 7/2 Carnoustie Station to Barry Burn	HTL	HTL	HTL	

G4.8 Scenario Area 8 – Buddon Ness

Table G4.8 Draft recommended preferred policies and revised management units for CSG 3 discussion– Buddon Ness

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
MU 8/1 Barry Sands East	HTL	HTL	MR or HTL	<p>HTL, HTL, MR: As long as the MoD are based at and use the Buddon Ness site, a hold the line policy will remain appropriate to continue to protect the nationally important facilities. However, the defences along the Barry Sands East frontage are and will have an increasing affect on coastal processes and environment designations over time and therefore a change to a managed realignment policy is recommended for the long term. If the MoD is still resident in the long term, a relocation of some assets will be required. At the end of the present defence’s residual life the present defences would be removed to restore the natural link between the dunes and the beach. Managed erosion of the dunes would provide new sediment to the local beach system, to the south and to the beaches north in Carnoustie Bay.</p> <p>HTL, HTL, HTL: Hold the line for all three epochs if there is a requirement from the MOD to continue to protect MOD assets along the Barry Sands East frontage into the long term.</p>
MU 8/2 Barry Buddon & Barry Sands West	NAI	NAI	NAI	No justification to change from current policy

G4.9 Scenario Area 9 – Monifieth to Broughty Ferry

Table G4.9 Draft recommended preferred policies and revised management units for CSG 3 discussion – Monifieth to Broughty Ferry

Revised SMP 2 Management Units	Draft Preferred Scenario			Rationale
	0-20 yrs	20-50 yrs	50-100 yrs	
MU 9/1 MoD Boundary to west Tayview Caravan Park	HTL	HTL	HTL	No justification to change from current policy. A hold the line policy in the east of the frontage may only involve limited intervention due to continued accretion, however more intervention would be required if the channel moves position and erosion is again instigated here in the future.
MU 9/2 Monifieth West	HTL	HTL	HTL	
MU 9/3 Barnhill to the Esplanade	HTL	HTL	HTL	
MU 9/4 Broughty Ferry East	HTL	HTL	HTL	
MU 9/5 Broughty Ferry	HTL	HTL	HTL	

G5 Agreed Consultation Draft Preferred Policies

During Client Steering Group meeting 3 (CSG 3), which took place on the 25th October 2012, the draft preferred policies as set out in Sections G4.1 to G4.9 were discussed and refined. No changes were made to the proposed revised management units boundaries as shown in Figures G4.1 to G4.6.

The outcome of discussions at the CSG 3 meeting resulted in the following changes:

- **Policy Scenario Area 1 - Montrose, Management Units 1/3 (a) Splash (The faultds) and 1/3 (b) South Links Holiday Park**

A long term policy of either managed realignment or hold the line along the Splash and adjacent holiday park frontages was put forward to the CSG for discussion. The CSG agreed that the most appropriate long term policy, considering the justification put forward (Table G4.1), would be **management realignment** in these two management units. The long term aspiration for these frontages would be for a more natural alignment of the coast where the dune system is reinstated and managed as the natural defence, and would provide new sediment to the system and beaches. The current 'unnatural' alignment of the Splash defences is unsustainable if current conditions continue and therefore once present defences come to the end of their useful life, it would be more appropriate to move the 'defence line' to a more sustainable, natural position landward, be it with hard (revetment) or soft (dunes) defences. Holding the line into the medium term will allow time for relocation of assets while a managed realignment policy would provide an opportunity to address the issues created by the current unsustainable alignment of the current defences at Splash while also providing flood and erosion risk to assets.

- **Policy Scenario Area 4 – Lunan Bay, Management Unit 4/2 Corbie Knowe**

A short term policy of hold the line followed by no active intervention in the medium and long terms was recommended along the Corbie Knowe frontage. The current ad hoc defences in this location provide varying degrees to erosion protection to the small number of holiday homes at Corbie Knowe. The defences are privately owned, and are in various states of disrepair. The CSG were concerned with the short term policy of hold the line as this may give the impression that new private defences could be built within the short term period (20 year). The vision for Lunan Bay as a whole is for a completely natural system to evolve; therefore, once defences fail at Corbie Knowe they would not be replaced. In line with the adjacent Lunan Bay management unit (MU 4/1), the CSG agreed that the preferred policies at Corbie Knowe should change to **no active intervention** for all three epochs. The no active intervention policy has been agreed on the understanding that private maintenance of defences could take place in the short term, however, following failure, no new defences would be allowed in this location.

- **Policy Scenario Area 8 – Buddon Ness, Management Unit 8/1 Barry Sands East**

A long term policy of either managed realignment or hold the line along the Barry Sands East frontage was put forward to the CSG for discussion. The CSG concluded that in the absence of any further information , it has to be assumed that the MoD will continue to use the Buddon Ness site over the timeframe of the SMP. Protection of MoD assets at Barry Sands East will therefore be required over the 100 year period through a **hold the line** policy. However, if this situation changes in the future, and the MoD withdraw from the site, the long term vision for Buddon Ness as a whole would be for the Ness to evolve as a completely natural system.

A summary of the agreed preferred policies for consultation are included in table G5.1.

Table G5.1 Agreed preferred policies for consultation

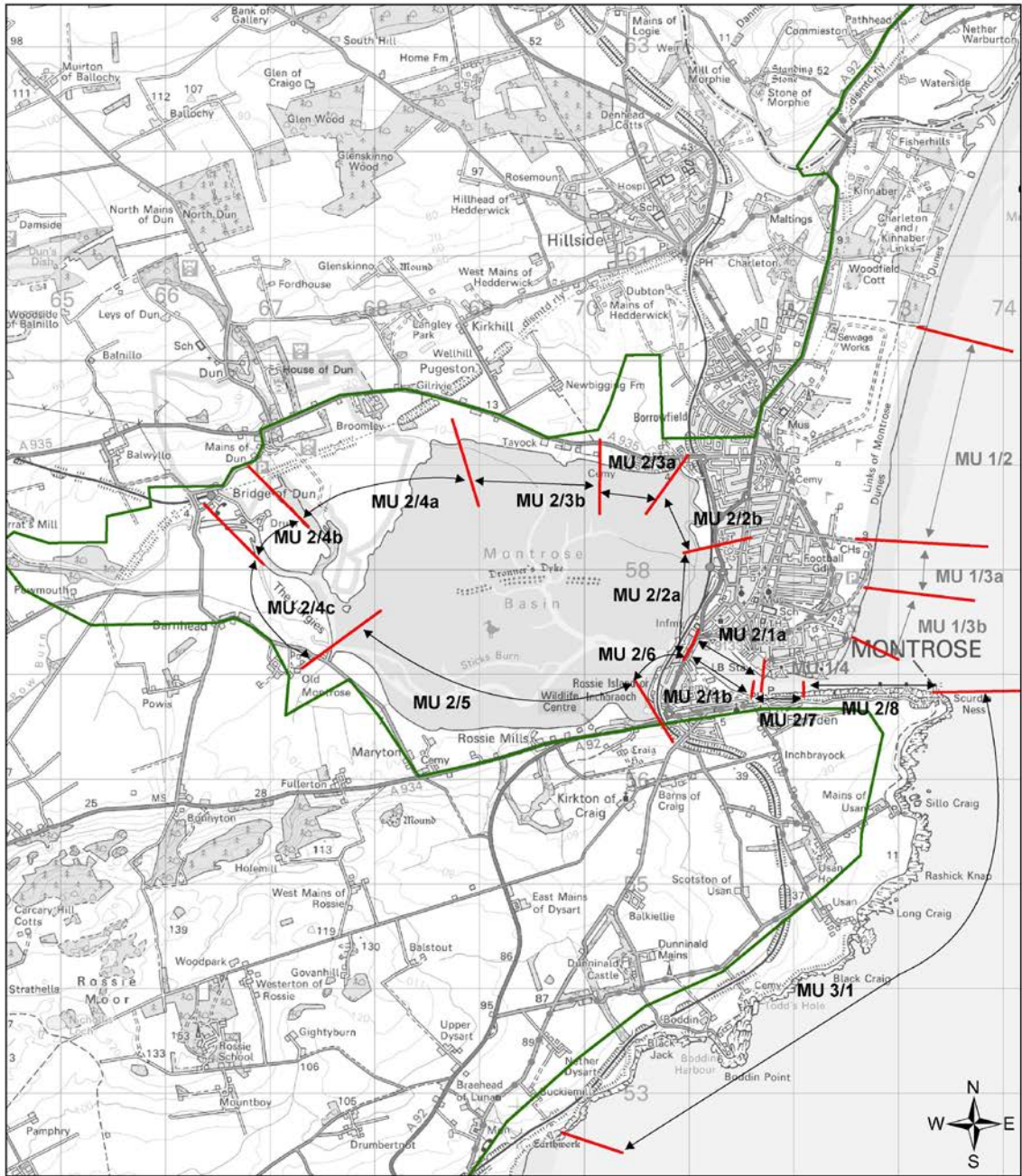
Scenario Area	Management Unit		Preferred Policy Scenario		
			0-20 yrs	20-50 yrs	50-100 yrs
1- Montrose	1/1	Montrose Bay (Milton Ness to Montrose Links)	NAI	NAI	NAI
	1/2	Montrose Golf Links	MR	MR	MR
	1/3 (a)	Splash (The Faulds)	HTL	HTL	MR
	1/3 (b)	South Links Holiday Park	HTL	HTL	MR
	1/4	GlaxoSmithKline	HTL	HTL	HTL
2- Montrose Basin	2/1 (a)	Montrose Port (north bank – Glaxo to A92 bridge)	HTL	HTL	HTL
	2/1 (b)	Montrose Port (south bank –A92 bridge to Ferryden)	HTL	HTL	HTL
	2/2 (a)	Montrose West (A92 Bridge to the end of railway defences)	HTL	HTL	HTL
	2/2 (b)	Montrose West (Railway defences to Tayock River)	HTL	HTL	HTL
	2/3 (a)	Tayock (Tayock village)	HTL	HTL	HTL
	2/3 (b)	Tayock (Sleepyhilllock Cemetery)	HTL	HTL	HTL
	2/4	West Montrose Basin (west of Tayock to Old Montrose)	MR	MR	MR
	2/5	Old Montrose to Railway Bridge	NAI	NAI	NAI
	2/6	Rossie Island to A92	HTL	HTL	HTL
	2/7	Ferryden	HTL	HTL	HTL
2/8	Ferryden to Scurdie Ness	NAI	NAI	NAI	
3- Scurdie Ness to Rickle Craig	3/1	Scurdie Ness to Rickle Craig	NAI	NAI	NAI
4- Lunan Bay	4/1	Lunan Bay	NAI	NAI	NAI
	4/2	Corbie Knowe	NAI	NAI	NAI
5- Lang Craig to Whiting Ness	5/1	Lang Craig to Whiting Ness	NAI	NAI	NAI
6- Arbroath to West Haven	6/1 (a)	Victoria Park	HTL	HTL	HTL
	6/1 (b)	Seagate	HTL	HTL	HTL
	6/2	Arbroath Harbour	HTL	HTL	HTL

Scenario Area	Management Unit		Preferred Policy Scenario		
			0-20 yrs	20-50 yrs	50-100 yrs
	6/3	Inchcape Park to Westway Road	HTL	HTL	HTL
	6/4 (a)	West Links to East Haven	HTL	HTL	HTL
	6/4 (b)	East Haven	NAI	NAI	NAI
	6/4 (c)	East Haven to West haven	NAI	NAI	NAI
7- Carnoustie	7/1	West Haven to Carnoustie Station	HTL	HTL	HTL
	7/2	Carnoustie Station to Barry Burn	HTL	HTL	HTL
8- Buddon Ness	8/1	Barry Sands East	HTL	HTL	HTL
	8/2	Barry Buddon & Barry Sands West	NAI	NAI	NAI
9- Monifieth to Broughty Ferry	9/1	MoD Boundary to west Tayview Caravan Park	HTL	HTL	HTL
	9/2	Monifieth West	HTL	HTL	HTL
	9/3	Barnhill to the Esplanade	HTL	HTL	HTL
	9/4	Broughty Ferry East	HTL	HTL	HTL
	9/5	Broughty Ferry	HTL	HTL	HTL

Following on from the CSG meeting, ongoing discussions with Angus Council and meetings with Scottish Natural Heritage (SNH) on the Habitat's Regulations Assessment (HRA) lead to an amendment to one Management Unit in Montrose Basin. Parts of the frontage MU2.4 - West Montrose Basin (west of Tayock to Old Montrose) are internationally designated and it was agreed that MR over designated habitat would not be acceptable in these locations. It was subsequently agreed that MU2.4 should be split further into MU2/4a, MU2/4b and MU2.4c, to reflect the designations and consequent policy changes, where MR would be recommended in the non-designated areas only. A summary of the agreed preferred policies for MU2.4 for consultation are included in table G5.2, and the extents are shown in Figure G5.1.

Table G5.2 Agreed preferred policy changes for MU2.4

Scenario Area	MU2/4 West Montrose Basin (west of Tayock to Old Montrose)		Preferred Policy Scenario		
			0-20 yrs	20-50 yrs	50-100 yrs
2 - Montrose Basin	2/4a	West Montrose Basin (west of Tayock)	HTL	HTL	HTL
	2/4b	West Montrose Basin (Bridge of Dun)	MR	MR	MR
	2/4c	West Montrose Basin (Old Montrose)	HTL	HTL	HTL



Project:
Angus Shoreline Management
Plan 2

Drawing:
SMP2 - Revised Management Units
(Map 2/6)



 

Drawn By: MPC 04/02/2016
Checked By: LW 04/02/2016
Approved By: SB 04/02/2016

0 0.25 0.5
Kilometres

Drawing Scale: 1:35,000
Plot Scale: 1:35,000 @ A3

Legend

-  Management Unit (MU)
-  Landward Boundary

Location Plan:



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Figure G5.1 Revised SMP 2 Management Unit boundaries Montrose Basin (MU2/4)

G6 References

Defra (2006) Shoreline Management Plan Guidance

Milne, F.D. and Dong, P. (2011) Management of Erosion at Montrose. Montrose Beach Environmental Development Plan Phase 1 Report. Angus Council, Forfar.