

Aberdeenshire Coastal Change Adaptation Plan

Blackdog & Balmedie

Draft

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Aberdeenshire Council**

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Executive Summary

The report documents the Coastal Change Adaptation Plan (CCAP) for the Blackdog and Balmedie Coastal Change Management Area (CA) in Aberdeenshire.

The CCAP provides an overview of the coastal flood and erosion risks to Blackdog and Balmedie, which are used to underpin development of possible Adaptation Pathways for this community. These are presented, along with a framework to support proactive coastal risk management, enable implementation of climate change adaptation actions and link with climate resilient development planning along Aberdeenshire's coast.

The Plan has been developed using available, datasets from Aberdeenshire Council, SEPA and the Dynamic Coast Project. It aims to directly support statutory and non-statutory Aberdeenshire Council policies, plans and strategies and aligns with key coastal climate change adaptation guidance and resources within and beyond Moray Council.

This Plan documents the Phase 0 starting point of adaptation, meaning that no definitive preferred Adaptation Pathway and associated Action Plan have been developed. Rather this Plan sets out a framework and process for Aberdeenshire Council to implement to effectively plan and support sustainable adaptation.

To develop Adaptation Pathways, the coast of the CA was classified into Coastal Management Units (CMUs) defined by:

- Classification of coastal landform type.
- Risk associated with coastal flooding and erosion.
- A total of two CMUs were identified, and one associated Adaptation Pathways were developed for each CMU.

To support delivery, an economic impact assessment was undertaken. This, in conjunction with the risk assessment, was used to establish initial outcome policies for each CMU.

These are set as either:

1. No intervention
2. Enhance natural features
3. Protect
4. Create Space

Delivery of these outcome policies is described by an Implementation Plan by defining Triggers and setting associated Actions against these. A single Implementation Plan is applied to the entire CA, where the outcome of the process determines what direction will be followed within the Adaptation Pathway. The Implementation Plan has three key stages:

1. Monitoring and Triggers
2. Actions
3. Outcomes

Trigger points are identified, and set following a risk-based approach and will be identified through repeat monitoring of available data that informs coastal flood and erosion risk.

Realisation of Triggers signal a need for review or change of the Adaptation Pathway. Actions bridge the gap between Triggers and Outcomes and define what processes need to be implemented before actions that deliver the idealistic policy Outcomes can be set.

In this iteration of the Blackdog and Balmedie Local Plan, a set of Phase 0 Actions have been identified that require immediate attention because of Triggers being met. Furthermore, this initial stage of the adaptation planning process has identified several knowledge gaps and opportunities for activities to be undertaken upfront to support coastal change adaptation at Blackdog and Balmedie. The current iteration of the CCAP is at Phase 0.

Triggers and Actions for each CMU in Blackdog.

CMU	Trigger	Action
1	Erosion Trigger met (Level 2)	Undertake assessment and plan for intervention
2	No current Triggers	No current Actions

As well as Triggers and Actions that correspond directly to the Adaptation Pathway and specified CMUs, Proactive Actions, which should be ongoing to support coastal change adaptation for the whole of Blackdog and Balmedie are summarised below:

1. Undertake dune enhancement in CMU 1 and CMU 2 and locations with vulnerable core paths.
2. Develop modelling framework to support future assessments.
3. Identify landownership and to support safeguarding and land-based planning for CMU with Make Space outcome policies.
4. Establish coordinated and consistent beach monitoring plan for Natural CMUs.
5. Undertake critical third-party sector engagement to quantify wider economic impacts.
6. Identify landownership and to support safeguarding and land-based planning for CMU with Make Space outcome policies.
7. Integrate future erosion projections into Local Development Planning to establish Coastal Change Management Areas.

1 Introduction

1.1 Coastal Change Adaptation Planning in Aberdeenshire

Our climate is changing and throughout history, the coast has responded to changes in sea level, storms, and other climate drivers. This means that the current position of Aberdeenshire's coast is not fixed, but dynamic, and will continue to evolve as our climate changes.

In a changing climate, traditional coastal risk management approaches will become a less sustainable means of managing and protecting communities against these risks. Rather, we need to become more resilient and adapt to our changing coast through combined coastal risk management with climate resilient development planning on land near the coast. To enable this, we must be proactive in making combined coastal risk and land management decisions which provide long-term space for the coast to naturally respond to coastal climate change risks.

Developing and implementing an Adaptive Framework now to address how we respond to the current and future risks can help to reduce costs and negative impacts such as assets eroding into the sea or suffering repeat frequent flooding. More positively, a proactive approach to adaptation and climate resilient development planning now can generate wider benefits and opportunities for coastal communities and the ecosystems which sustain and support them.

The Coastal Change Adaptation Plans (CCAPs) provide a key first step in this process; they are a practical mechanism to enable proactive engagement with and involvement of communities to co-develop a shared vision for long-term societal resilience to coastal climate change risk and impacts.

To support this adaptation journey in Aberdeenshire the coast has been subdivided into Community Areas (CAs) (Figure 1-1). Blackdog and Balmedie is one of the CAs identified as being a priority for a CCAP. The coast of the Blackdog and Balmedie is consists of a soft, dune system, acting as a natural defence against erosion and flooding. This provides primary motivations for a more detailed, local, CCAP which is contained in this document.



Figure 1-1: Extent and location of CAs within Aberdeenshire.

1.2 What is a Local CCAP?

A Local CCAP follows the same principle as the Regional CCAP¹ but is assessed and developed at a finer level of detail for a specified CA. A local CCAP is developed where a CA has been identified as a high priority, based on risk, development, management and socio-economic Indicators (see Regional Plan for more details). It divides the coast of the CA into individual Coastal Management Units (CMUs) and presents Adaptation Pathways for each. See section 2.2 for more details on CMUs and CMU classification.

¹ Aberdeenshire Coastal Change Adaption Plan - Regional Plan

1.3 What are adaptation pathways?

Adaptation Pathways offer flexible tools for local authorities, politicians, businesses, and residents to make informed decisions about coastal change and uncertainty. Beyond traditional management, these pathways highlight the value of working with natural processes, enhancing the environment, and implementing supportive steps like land safeguarding to prepare for rising sea levels, erosion, and flooding.

Their goal is to identify climate-resilient risk management and development options for each CMU, allowing decisions to be adjusted dynamically over time. Triggers within Adaptation Pathways indicate when current approaches should be reviewed and possibly changed based on new information or shifting risks.

1.4 What is the focus of the Local CCAP?

Adapting to coastal and climate change requires two parallel streams:

1. Land-based initiatives to prevent new future risk.
2. Management initiatives to reduce current and future risk.

The Local CCAP presented here focuses only the management initiatives but, only by considering these in parallel with those land-based will result in a sustainable adaptation journey for Aberdeenshire. This should identify both the need and practical steps required to safeguard land to support where areas of retreat may be considered in the future.

1.5 Where are we on the adaptation journey?

The aim of this first CCAP is to consolidate our understanding of the physical risks and how these interact with communities and their assets to identify the present day and future hazards of our changing coast for Blackdog and Balmedie. It then identifies and promotes a process that, when implemented by Aberdeenshire Council, will support community adaptation to coastal change.

The adaptation journey is a multiphase, multiyear process and aims to transition communities into a more sustainable and resilient future. We are currently at Phase 0, meaning that no definitive preferred Adaptation Pathway and associated Action Plan have been developed. Rather initial and end outcome policies are defined. Through the process these will be implemented through identified actions for delivery.

1.6 What is the Phase 0 Adaptation Framework?

The overall aim of the Adaptation Framework set out in this Local CCAPs is to:

Guide Aberdeenshire Council towards development of detailed Adaptation Pathways and associated Action Plans for the Blackdog and Balmedie CA.

To achieve this goal the following objectives have been set for Phase 0:

- Identify and characterise local CMUs within the CA suitable for development future Adaptation Pathways.
- Present coastal flood and erosion risk for each CMU.
- Identify CA and CMU specific Triggers that will influence adaptation decision making.
- Develop an Implementation Plan to be used by Aberdeenshire Council to support adaptive decision making, future action planning and evaluation of adaptation options.
- Identify and set Proactive Actions that will support delivery of the CCAP in each CMU.
- Inform and support the Local Development Plan² and Local Planning Policy. These should be implemented in parallel to avoid future risk by making space for change.

1.7 How has this framework been developed?

The approach to coastal change adaptation in Aberdeenshire is presented in the Regional Plan which distils the Scottish Government guidance³ into four key pillars of adaptation (Figure 1-2). Development and application of the CCAP Implementation Plan should align with these principles.



Figure 1-2: Four pillars of coastal adaptation for Moray.

² [Aberdeenshire Council Local Development Plan 2023](#)

³ [Coastal Change Adaption Plan Guidance - Scottish Government](#)

1.8 How does the Local CCAP link to the Regional CCAP?

The Regional CCAP links to the Local CCAP in these keyways:

1. Defining the prioritisation of Local CCAP with risk, development, management, and socio-economic Influence Factors (see Regional Plan for more details).
2. Setting wide Proactive Actions that, when implemented, should be used to support Local CCAP Action Plans.
3. Providing the links between the land-based components of the Adaptation Planning process. This includes links with the LDP and delivery of necessary regional actions required to effectively support and plan for adaptation at a local level e.g. land safeguarding.

2 Plan Overview

2.1 Plan Area and Characteristics

The Blackdog and Balmedie CA covers an area of ca.51 km² and is located between Aberdeen city and Foveran CA. The CA includes a range of coastal environments and land use areas (Figure 2-1).

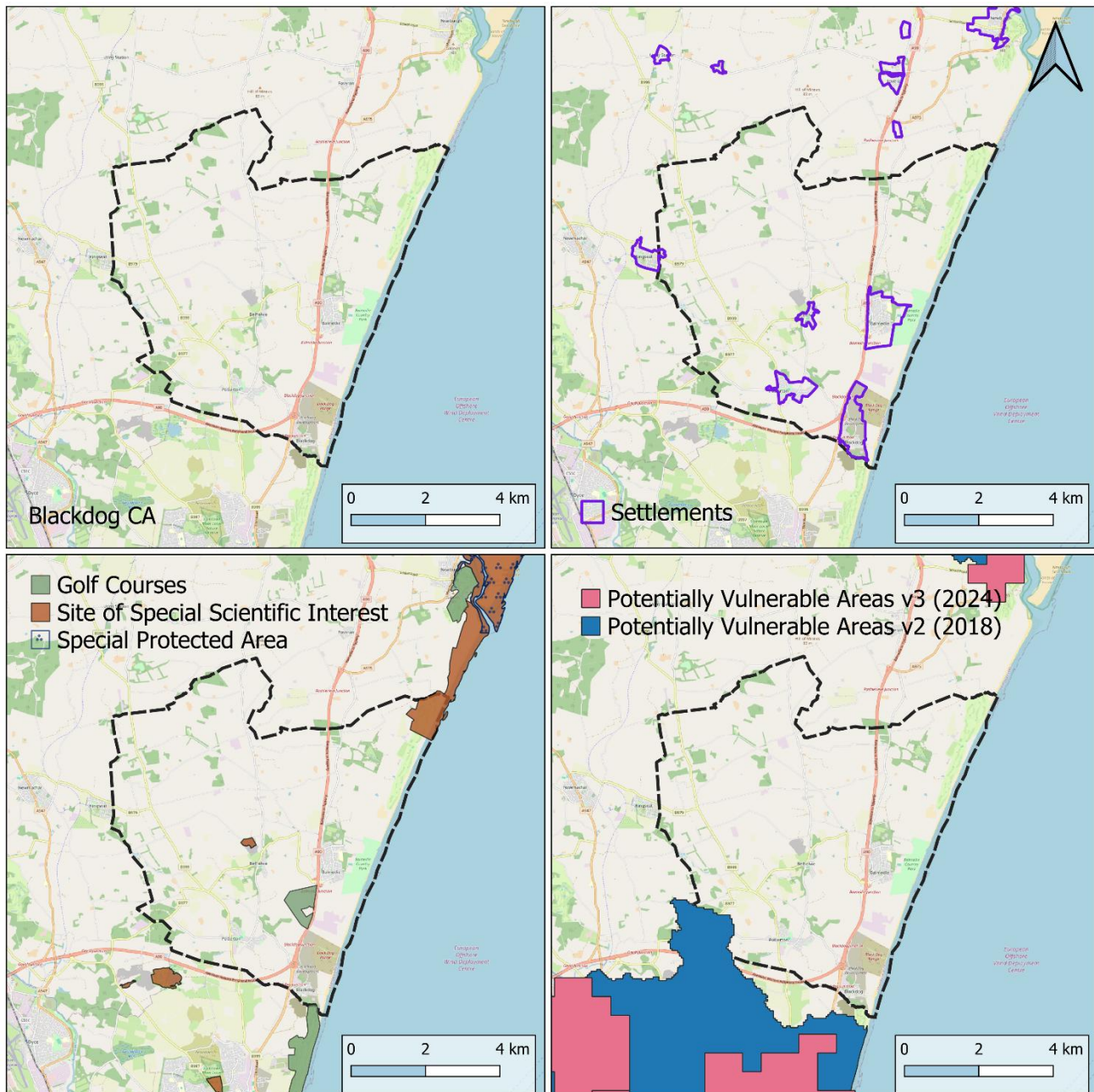


Figure 2-1: Blackdog and Balmedie LPA, showing settlements, greenspace and environment and special consideration areas

Settlements:

The Blackdog and Balmedie CA includes the coastal settlements of Blackdog in the south, as well as the inland settlements of Balmedie and Belhelvie in the north. Balmedie with a population of 2,510, is the largest settlement in the area⁴. The Aberdeenshire Council Local Development Plan (LDP) designates specific areas for land use within settlements and rural communities.

Greenspace and Environment:

The coast of the Blackdog and Balmedie CA from its northern extent to the end of the dunes at Sandend Burn, is a Nature Scot designated Site of Special Scientific Interest (SSSI). Trump International Golf Links Aberdeen is situated within the Menie SSSI-designated area of the LPA and remains a recreational and tourism asset for the surrounding region.

Special consideration areas:

The Blackdog and Balmedie CA contains part of the west of Potterton. Potentially Vulnerable Area (PVA) as identified in the Northeast Local Plan District – Local Flood Risk Management Plan (2022 - 2028) (LDP6)⁵.

Habitats:

There are three key habitats along the coastal extent of Blackdog and Balmedie as identified by NatureScot (Figure 2-2). These habitats include shifting dunes, unvegetated sand beaches and fixed dunes.

⁴ [Aberdeenshire Council - Population Statistics](#)

⁵ [Aberdeenshire Council. 2022. Northeast Local Plan District - Local Flood Risk Management Plan.](#)

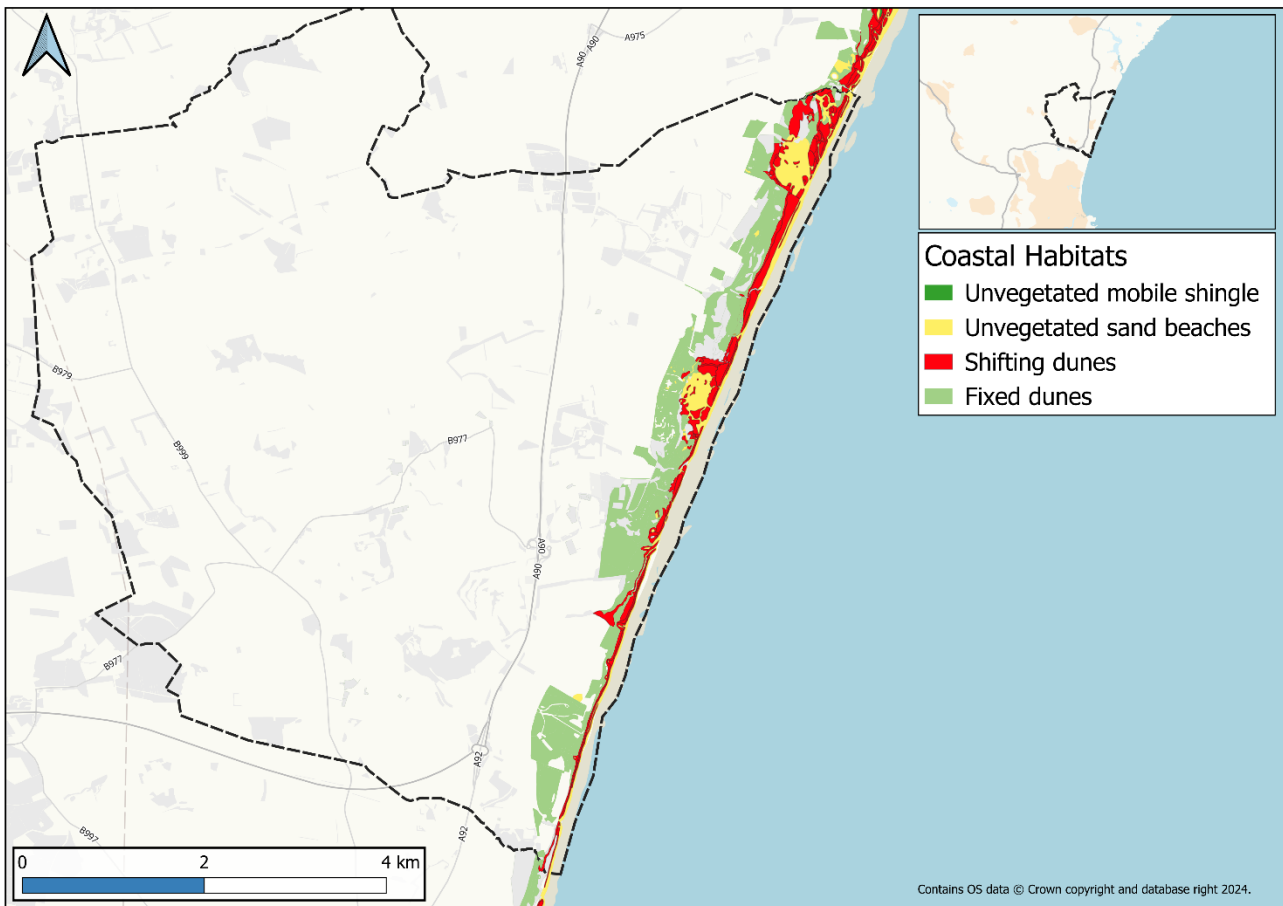


Figure 2-2: Coastal habitats at Blackdog and Balmedie as identified by NatureScot.

2.2 Coastal Management Units

To facilitate the development of this Local CCAP, the coast of the CA is classified into Coastal Management Units (CMUs) defined by:

1. Classification of coast type.
 - Natural – beaches, cliffs, dunes, saltmarshes, etc.
 - Defended – formal engineered structures.
 - Hybrid – combination of a and b
2. Risk associated with coastal flooding and erosion.
 - Risk and Hazard
Assets present in CMU, which are at risk of flooding/erosion hazard.
 - Risk and Unknown Hazard
Assets present in CMU, no data on flood/erosion risk available.
 - No Risk and Hazard
No assets present in CMU, but there is still a flooding/erosion hazard.
 - No Risk and No Hazard
No assets present in CMU, no flooding/erosion hazard.

Following this, the Blackdog and Balmedie CA coast has been subdivided into two CMUs (Figure 2-3). These are described below including a summary of the coastal change and flood risk.

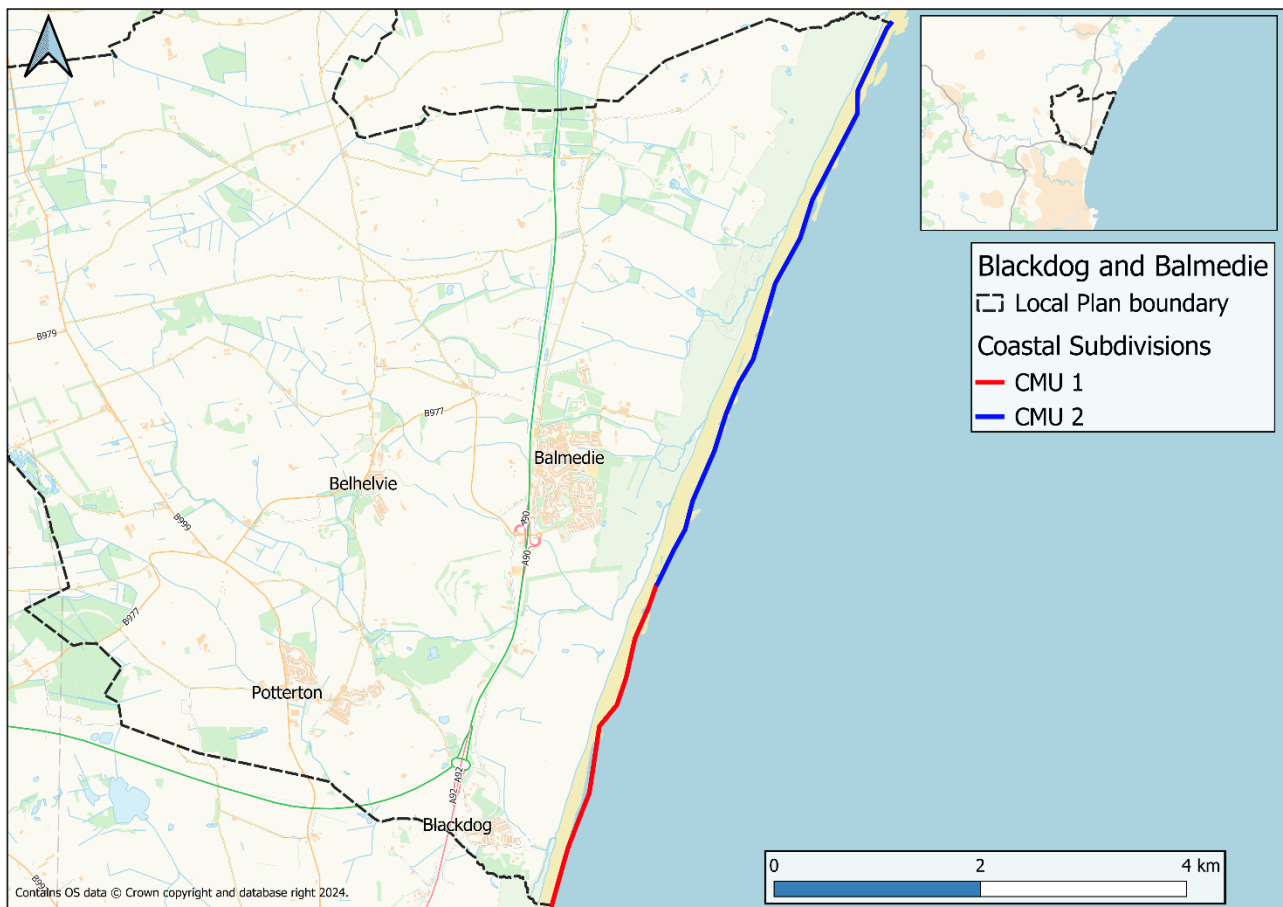


Figure 2-3: CMUs within the Blackdog and Balmedie CA.

2.2.1 CMU 1: Blackdog Dunes

CMU 1 is a natural dune system with a steep, eroding sand face and sparse vegetation, indicating ongoing sand loss and instability. Behind it, a higher, vegetated crest remains more stable with limited sediment movement. This unit includes the Blackdog Burn stream outflow. Coastal erosion risk is predicted by 2100, potentially impacting the Vattenfall site and properties at risk. Currently, no coastal defences exist along the Blackdog and Balmedie coastline.

Dynamic Coast 2 data indicates that this section of coastline has historically eroded at a maximum rate of 7.8 m/yr. Projected shoreline retreat could lead to land loss of up to 680 m by 2100, placing both residential and non-residential properties at risk from coastal erosion. However, where recent observations suggest accretion or reduced erosion, the immediate threat may be limited, potentially delaying significant impacts into the medium to long term.

Under a future 1 in 200-year event, flooding is primarily contained within the area but may impact residential properties at the southern end. Flooding in the northern section is more likely linked to CMU 2, as higher ground limits inundation along the shore.

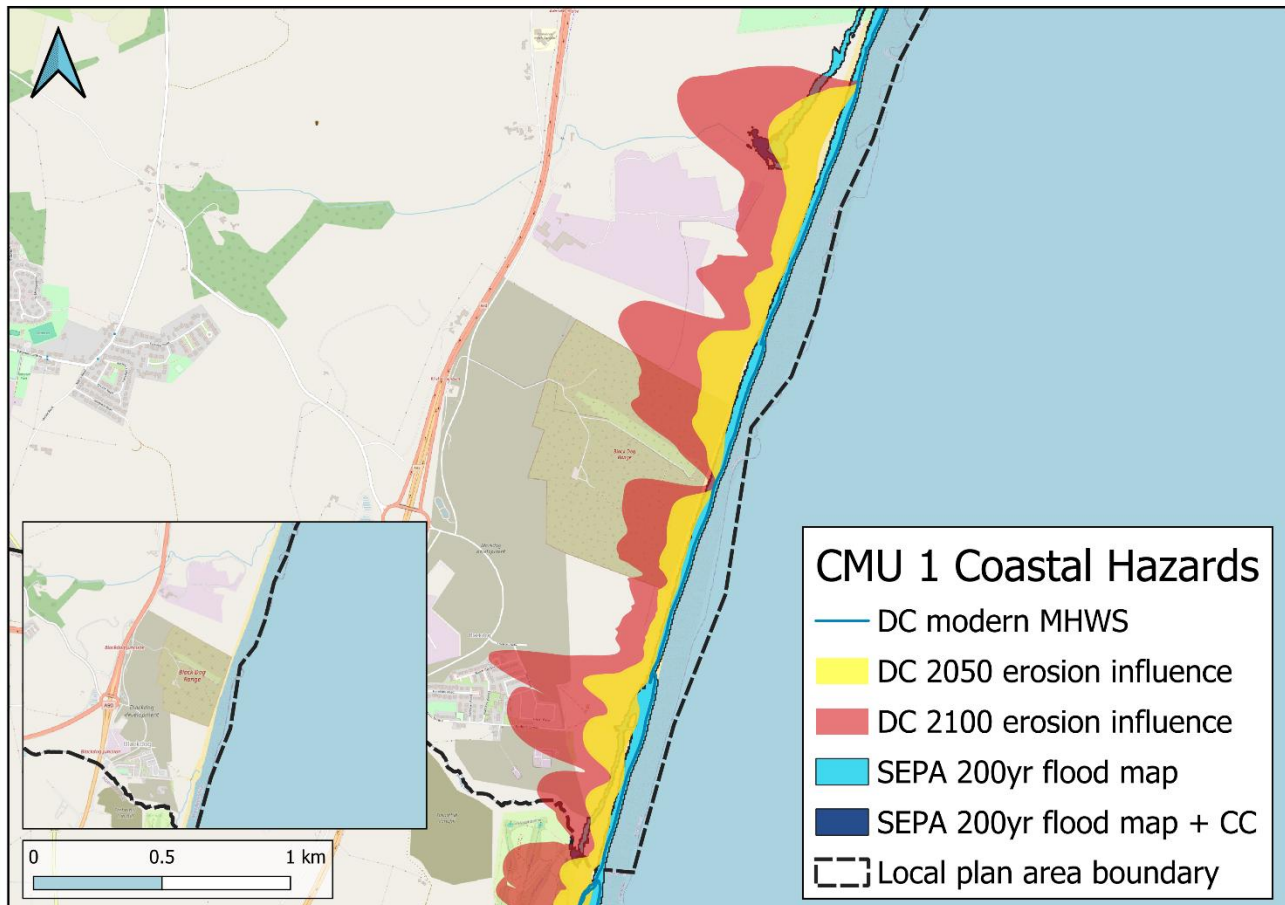


Figure 2-4: CMU1 coastal hazards map showing SEPA flooding extents and Dynamic Coast (DC) future erosion. Inset shows CMU without coastal hazards.

Table 2-1: CMU 1 Dynamic Coast erosion summary.

Dynamic Coast calculation	Results	
Historical rate	7.8 m/yr	Maximum
	2.5 m/yr	Median
2050 rate	8.3 m/yr	Maximum
	2.9 m/yr	Median
2050 distance	242.1 m	Maximum
	81.6 m	Median
2100 rate	8.9 m/yr	Maximum
	3.6 m/yr	Median
2100 distance	680.2 m	Maximum
	251.1 m	Median

Predicted future dune erosion associated also has the potential to expose and destabilise a number of historic landfill sites located within or landward of the dune system in CMU1. As erosion progresses, previously contained waste materials may become exposed, increasing the risk of pollutant release to the coastal and nearshore environment and creating potential health, environmental, and regulatory concerns. There is therefore a need to review the location, condition, and contents of these sites in the context of future shoreline change, and to assess the implications for risk management and intervention. The findings of this review should directly inform priorities, options, and actions incorporated into the next phase of the CCAP.

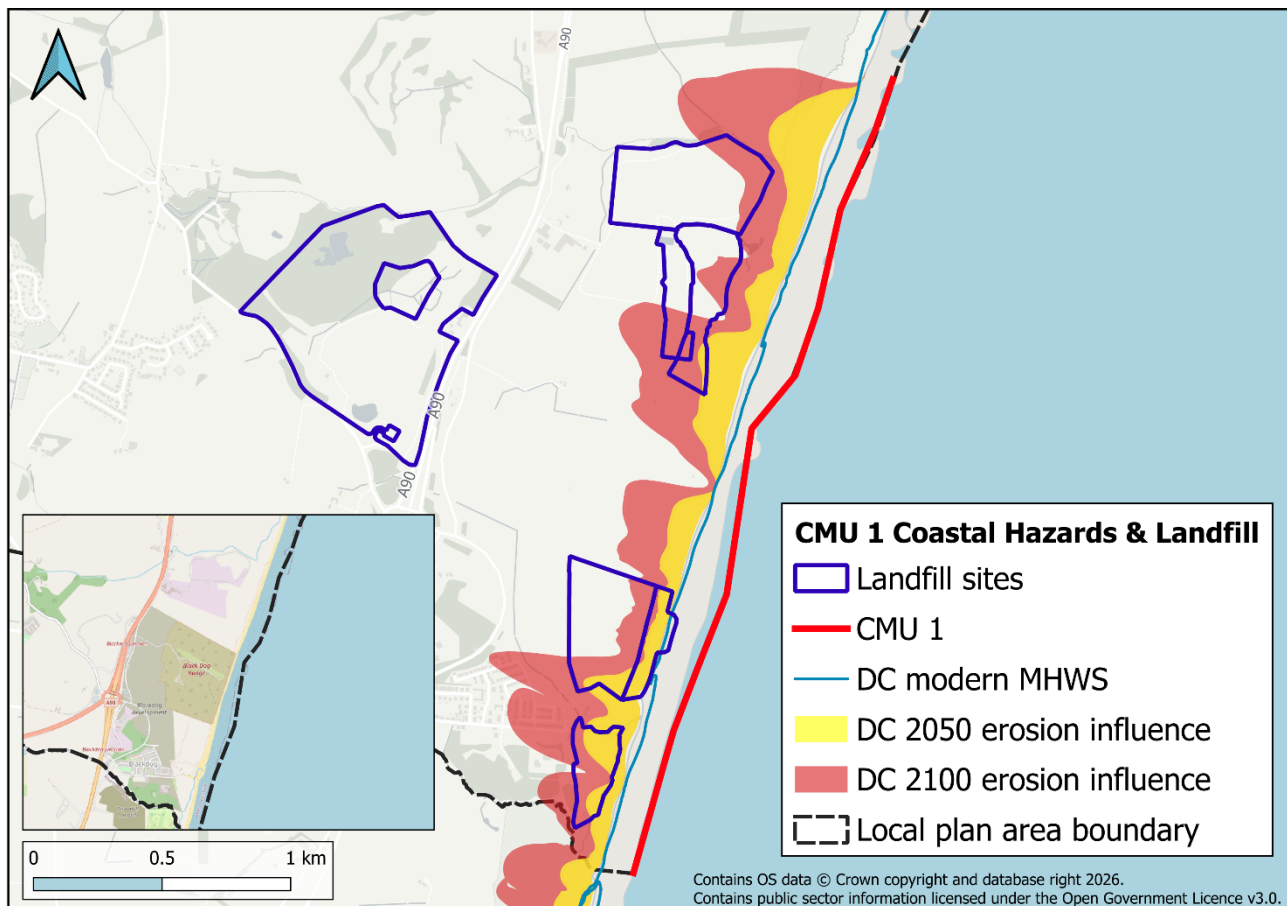


Figure 2-5: CMU1 coastal hazards mapped against approximate extents of historic landfill sites.

2.2.2 CMU 2: Balmedie Dunes

CMU 2 is a natural dune system with a steep, eroding sand face and sparse vegetation, indicating sand loss and instability. Behind it, a higher, vegetated crest remains more stable with limited sediment movement. Currently, no coastal defences exist along the CMU.

Dynamic Coast 2 data indicates that this section of the coastline has historically experienced a maximum erosion rate of 2.8 m/yr. However, predicted shoreline retreat could result in land loss of up to 680.2 m by 2100, the golf course at potential risk. Despite these projections, current observations suggest this area is experiencing accretion,

indicating a more stable shoreline condition compared to CMU 1. This relative stability may reduce the likelihood or timing of future erosion impacts in the medium to long term. The golf course is at risk from coastal erosion by 2100.

Under a future 200-year event, flooding is primarily contained within the low-lying coastal areas particularly in the central and southern parts of the CMU 2 which will affect access points to the beach but will not impact any residential or non-residential properties.

Under a 1 in 200-year flood event, the golf course is at risk.

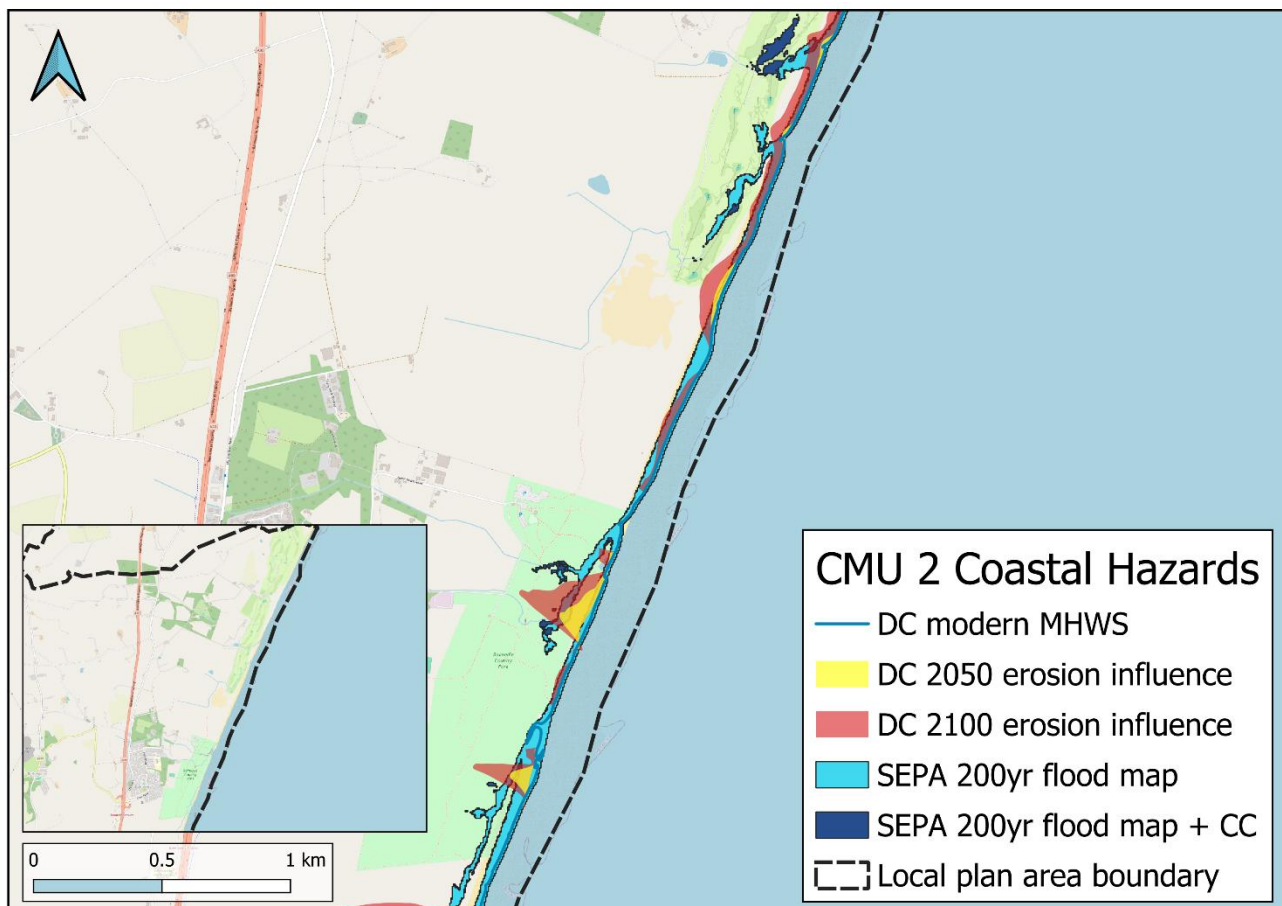


Figure 2-6: CMU 2 hazards map showing SEPA flooding extents and Dynamic Coast (DC) future erosion. Inset shows CMU without coastal hazards.

Table 2-2: CMU 2 Dynamic Coast erosion summary.

Dynamic Coast calculation	Results	
Historical rate	2.8 m/yr	Maximum
	+0.33 m/yr (accretion)	Median
2050 rate	3.3 m/yr	Maximum
	0.23 m/yr	Median
2050 distance	91.77 m	Maximum
	1.6 m	Median
2100 rate	4.08 m/yr	Maximum

Dynamic Coast calculation	Results	
	0.97 m/yr	Median
2100 distance	282.8 m	Maximum
	40.4 m	Median

2.3 Core paths

Within the Blackdog and Balmedie CA core paths are the most immediately vulnerable assets at risk from erosion and can be used to help prioritise where potential NBS may provide the greatest benefit.

The location and extent of core path sections predicted to be at risk are shown below (Figure 2-7).

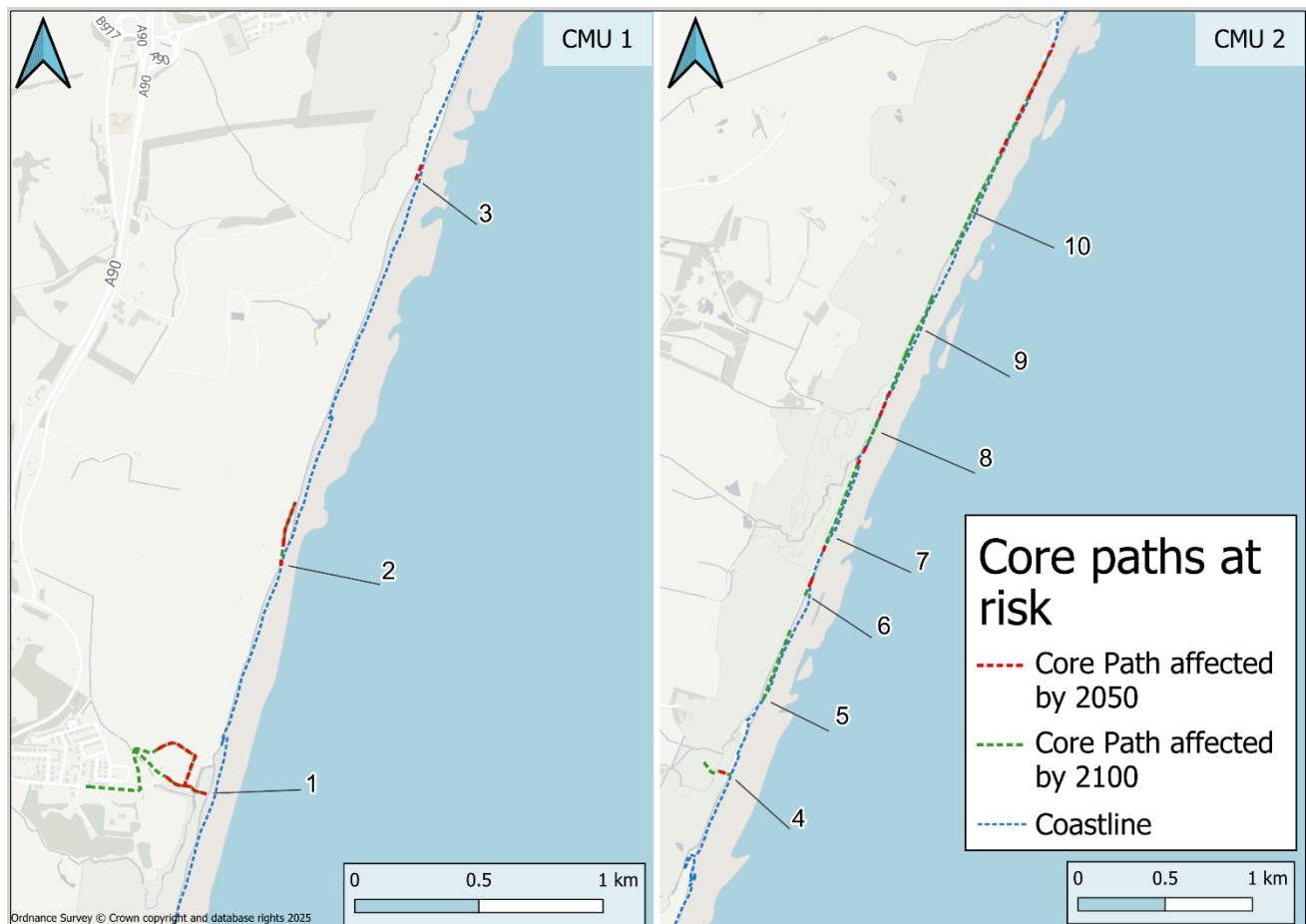


Figure 2-7: Coastal erosion risk for Blackdog and Balmedie core paths. Number refers to core path at risk by 2100 and 2050, detailed in Table 2-3 and Table 2-4.

CMU 1 and CMU 2 comprise of approximately 3km and 6km of sand beach respectively, with extensive stretches of fixed and shifting dunes, and unvegetated sand beaches. Here opportunities for sand nourishment could potentially be explored, by taking advantage of the regular south to north drift, through offshore placement of sediment in the surf zone. In addition, the planting of native dune vegetation to help stabilise the dunes, enhance

resilience, and slow down or prevent future erosion is worth considering. Any addition of dune vegetation should consist of locally native plant species.

Using Dynamic Coast projection data, a matrix was produced to highlight the sections of core path at risk from erosion by 2050 (Table 2-4) and 2100 (Table 2-3). The sections have been ranked according to the approximate area of land predicted to be affected by erosion. The ranking considers the product of path section length and mean predicted total erosion distance. This should give an overview of the areas of core path most at risk from future erosion and serve as an aid when targeting for intervention.

Table 2-3: Blackdog and Balmedie. Core path sections at risk erosion by 2100

Core Path network name	Feature ID	Mean land loss by 2100 (10m intervals)	Core Path affected by 2100 (m)	Approximate total land loss by 2100 (m ²)	Distance to shore (m)	Rank - 2100 land loss total
Blackdog to Beach	1	-60	1124	68,564	40	1
Coastal Path Newburgh Aberdeen City Boundary	10	-10	1236	12,496	0	2
Coastal Path Newburgh Aberdeen City Boundary	9	-10	639	6,423	0	3
Coastal Path Newburgh Aberdeen City Boundary	2	-24	252	6,015	4	4
Coastal Path Newburgh Aberdeen City Boundary	7	-10	551	5,328	0	5
Coastal Path Newburgh Aberdeen City Boundary	4	-24	175	4,204	8	6
Coastal Path Newburgh Aberdeen City Boundary	8	-12	296	4,179	0	7
Coastal Path Newburgh Aberdeen City Boundary	5	-8.8	449	3,932	2	8
Coastal Path Newburgh Aberdeen City Boundary	6	-11	106	1,171	0	9
Coastal Path Newburgh Aberdeen City Boundary	3	-16	69	1,096	4	10

The majority of core coastal path within CMU1 and CMU 2 is at risk from erosion by 2100 with the most land loss predicted for sections 1 and 10. This highlights their vulnerability and reinforces that the scale of erosion impact remains highest in these sections across both epochs.

The proximity of the core paths to the shore where erosion is predicted by 2050 should be considered alongside land loss by 2050 and 2100 when targeting areas for NBS intervention.

Table 2-4: Blackdog and Balmedie. Core path sections at risk erosion by 2050

Core Path network name	Feature ID	Mean land loss by 2100 (10m intervals)	Core Path affected by 2100 (m)	Approximate total land loss by 2100 (m ²)	Distance to shore (m)	Rank - 2100 land loss total
Blackdog to Beach	1	-60	463	27,791	40	1
Coastal Path Newburgh Aberdeen City Boundary	10	-10	489	4,890	0	2
Coastal Path Newburgh Aberdeen City Boundary	2	-24	198	4,752	4	3
Coastal Path Newburgh Aberdeen City Boundary	8	-12	116	1,392	0	4
Coastal Path Newburgh Aberdeen City Boundary	3	-16	53	1,272	4	5
Coastal Path Newburgh Aberdeen City Boundary	4	-24	52	1,248	8	6
Coastal Path Newburgh Aberdeen City Boundary	7	-10	63	630	0	7
Coastal Path Newburgh Aberdeen City Boundary	6	-11	53	583	0	8

Core Path network name	Feature ID	Mean land loss by 2100 (10m intervals)	Core Path affected by 2100 (m)	Approximate total land loss by 2100 (m ²)	Distance to shore (m)	Rank - 2100 land loss total
Coastal Path Newburgh Aberdeen City Boundary	9	-10	44	438	0	9

3 Economic Impact Assessment

3.1 Erosion damages assessment

To support development of management policies it is critical to understand the potential damages that could be realised from coastal erosion, should nothing be done. We have undertaken a review of Dynamic Coast to evaluate economic damages.

An assessment has been undertaken to calculate damages to residential properties and non-residential properties at risk from coastal erosion in the CA. This is based on assets within the erosion influence area defined by the Dynamic Coast projections.

Coastal erosion damages are based on the market value of buildings being written off in the year in which they are impacted by erosion. To determine present value damages, the value of the assets written off by erosion damage is discounted by the discount factor associated with the year of loss as set out in the Green Book (HM Treasury, 2022). Residential and non-residential property values are set out in sections 3.1.1 and 3.1.2 respectively.

3.1.1 Residential property values

Residential property market values were obtained for each property type using 2023 annual house price statistics provided by Registers of Scotland for Aberdeenshire Council. Regional values are used to represent 'risk-free' valuations as specified by the Flood Hazard Research Centre. This information, broken down by property type, is shown in Table 3-1. Residential property types were determined by cross referencing the information in the Dynamic Coast receptors at risk dataset with the most up to date Multi-Coloured Handbook codes and property descriptions.

Table 3-1: Market value of residential properties by property type (2025).

Property type	Market value (£)
Detached	372,159
Semi-detached	228,243
Terraced	195,017
Flat	135,920

3.1.2 Non-residential property values

Non-residential property market values were calculated using Multi-Coloured Manual (MCM) guidance. Market values for non-residential properties were estimated from a property's rateable value⁶ per metre squared of floor space, as per Table 5.4 of the MCM. Rateable values for the northeast of England were used and are a suitable proxy for

⁶ Rateable Value - How much rent a commercial property could be let for.

Scotland. Prime yield⁷ multipliers, informed by MCM Table 3.4, are given for certain categories of non-residential properties, and associated multipliers are calculated by dividing 100 by the prime yield percentage. Property areas are provided by the Dynamic Coast receptor at risk dataset.

A non-residential property market value per metre square can be calculated by multiplying the mean rateable value per m² by the prime yield multiplier, found in Table 3-2.

Table 3-2: Rateable value per m², prime yield, and market value for non-residential properties.

NRP type	Mean rateable value per m ²	Prime yield (%)	Multiplier (100/prime yield)	Market value per m ²
Industrial	58	5.25	16.7	£969

3.1.3 Erosion damage results

Erosion damages have been calculated for properties only as direct damages. Indirect property damages, intangible damages including increased vulnerability, and transport disruption have not been calculated.

Properties are considered to be written off if they fall within the erosion projections or are in the influence of erosion projections as outlined in the Dynamic Coast receptor at risk dataset. To find present value erosion damages, the market value of the properties at risk is discounted to present day based on the year at which the property is expected to be impacted by erosion.

Several properties in Blackdog that were not included in the current SEPA receptor dataset have been identified. These properties are part of a residential property development in the town that is impacted by erosion under the 2100 erosion contours. These properties have been manually included in the property dataset. In addition to the residential properties identified, the Vattenfall electricity distribution site was also not included in the original property dataset and has been manually added to the damage calculations as it is predicted to be impacted under the 2100 erosion contour.

For the CA the present-value damages for Blackdog are presented in Table 3-3.

Table 3-3: Receptor counts, and present-value damages associated with coastal erosion

Area	Receptor count	Present-value damages (£k)
Blackdog	98	£2,741

3.1.4 Wider Economic Impact

As well as the direct flood and erosion damages to properties, these hazards will contribute to wider economic impact across the CA by affect several key sectors. Together these will

⁷ Prime Yield - A measure of the value of return on investment in the property - Higher = safer, lower = riskier.

result in additional consequences for local and regional economic growth. Key additional impacts from erosion in the CA are:

- The development and housing sector with new development and properties shown to potentially be vulnerable to coastal erosion in the future.
- The recreation and tourism sector with isolated pockets of the Trump International Golf Links being at risk in the future.
- Substantial predicted impact to the Aberdeenshire core path network is predicted.
- Local and isolated impacts to businesses are predicted and may have knock on impacts to the supply chain or wider sector. Through review of available information this potentially includes renewable energy infrastructure (Vattenfall UK).

4 Nature Based Solutions

Working with natural processes forms one of the four key pillars of adaptation. Nature based solutions (NBS) in a coastal setting focus on the use and enhancement of natural systems to reduce the impacts of erosion and flooding while maintaining resilience to climate change. This could involve "buying time" by slowing down erosion. Opportunities for Nature-Based Solutions (NBS) for each Coastal Management Unit (CMU) are outlined below (Figure 4-1).

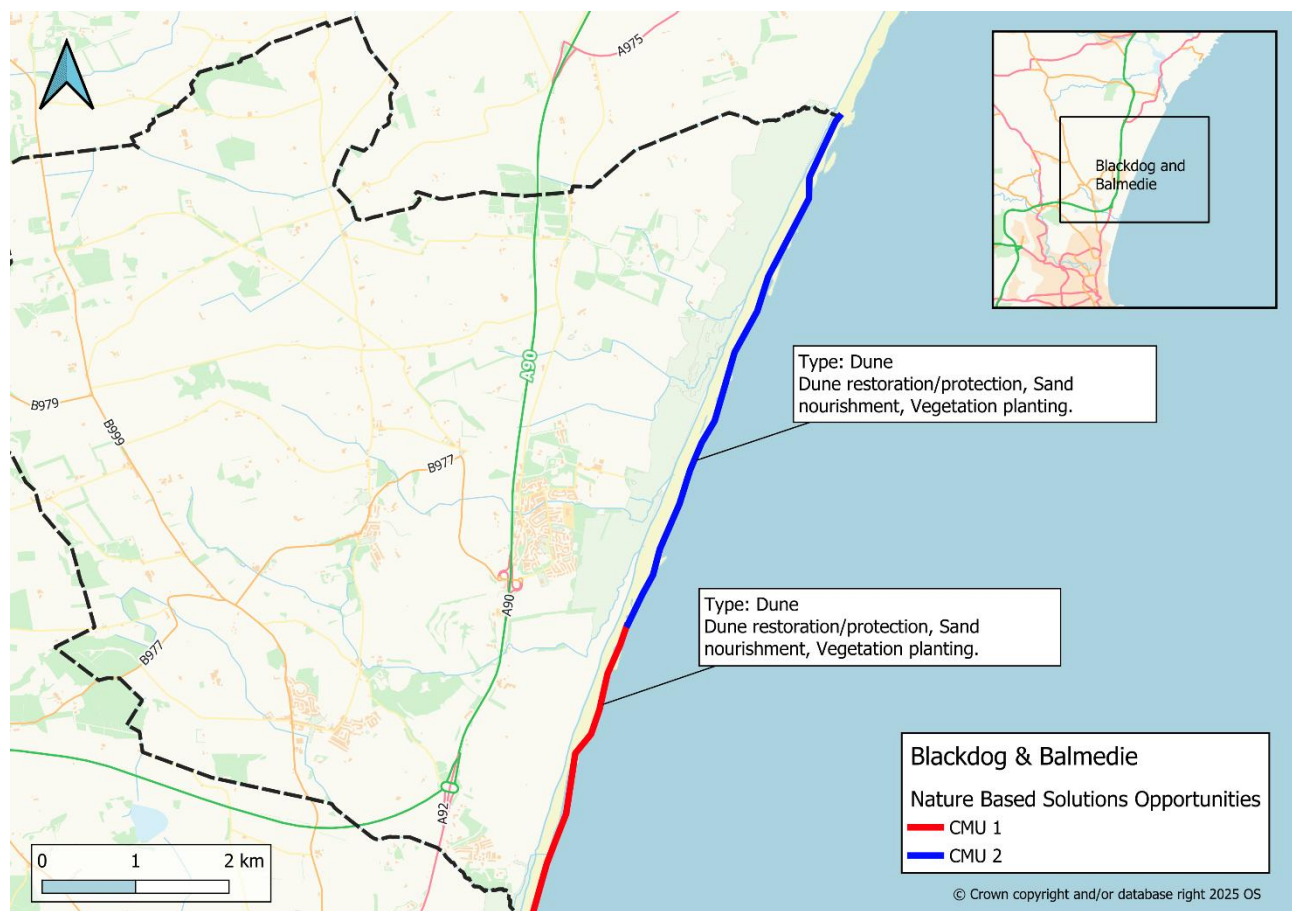


Figure 4-1: Suggested NBS locations and extent, with associated CMU.

4.1 NBS Opportunities

Healthy dune systems can help slow down or prevent the loss of land from erosion and flooding from storm events.

Well established vegetation can help trap and accumulate wind blown sediment, with root systems acting to support stabilisation of the overall dune. Additional benefits from increasing biodiversity, creation of habitat and social well-being can also be attributed to healthy dunes and beaches.

Given the extent of predicted erosion risk to the core path network in the Blackdog and Balmedie CA (see Section 2.3), a complete review of the impacts of erosion is recommended to make sure that NBS opportunities are developed where appropriate and future realignment or re-development of the core paths consider these future risks.

5 Land Based Opportunities

Where possible, the delivery of adaptation should include land-based actions. Fundamentally these include actions that support more sustainable planning and the potential future relocation of assets and receptors that are, or will be, at risk of erosion or flooding. To identify this a land-based opportunities mapping exercise was undertaken. This focused on each CMU and the CA to understand potential to identify areas where future erosion losses could be offset through safeguarding.

Consideration here is to fundamentally support that although the location of assets or receptors must change the functional impact on the CA should not be lost. Various future needs such as environmental sustainability, urban development, societal and economic development should be considered.

Land-based opportunities in the Blackdog and Balmedie CA are highlighted below (Figure 5-1).

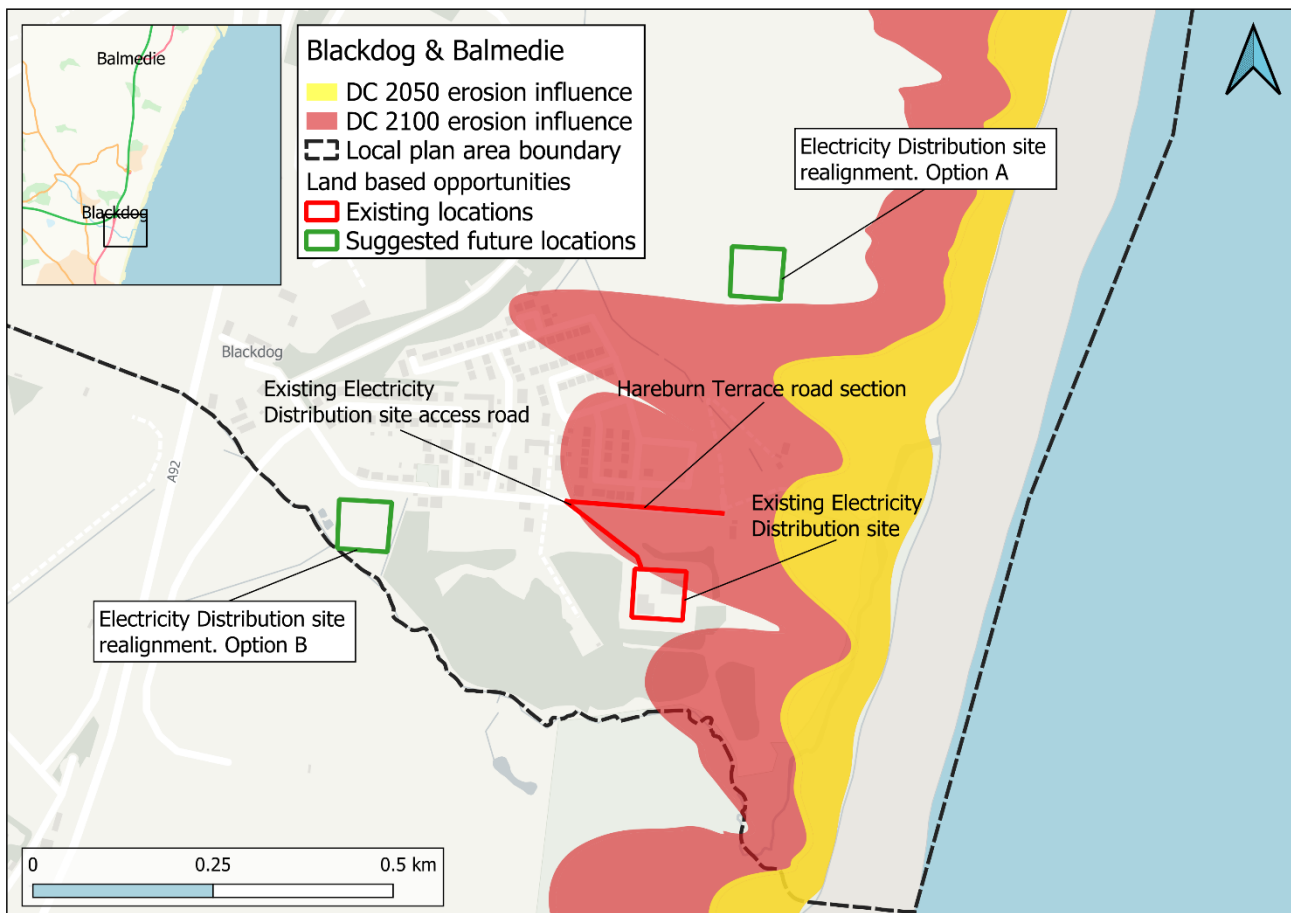


Figure 5-1: Land based opportunities.

5.1 Hareburn Terrace diversion and Electricity Distribution site

The electricity distribution site access road, running from the middle of The Hareburn Terrace to the site, is at risk from erosion by 2100, along with The Hareburn Terrace south

of Blackdog. However, the roads in Blackdog are not at risk of flooding. Consideration should be given to permanently realigning the road and identifying a suitable site to relocate the electricity distribution facility.

The electricity site at Blackdog is a privately operated substation developed by Vattenfall UK, the UK subsidiary of Vattenfall AB, a Swedish state-owned energy company. The substation was built to support the Aberdeen Offshore Wind Farm (EOWDC)⁸.

5.2 Development Restrictions and Establishment of a CCMA

The risk assessment has highlighted that considerable areas of new development are potentially at risk of erosion in the future. With additional development planned it is imperative that this erosion risk is better understood and incorporated directly to inform decisions and support planning applications. The following land-based actions are required to support.

1. Pause all development yet to apply for planning permission.
2. Review any outstanding planning permission applications.
3. Establish defined Coastal Change Management Area for Blackdog to restrict future development activities.
4. Undertake engagement with developers and landowners.
5. Incorporate CCMA in the LDP policies.

⁸ Vattenfall. (2018). Available at: <https://www.vattenfall.co.uk/our-projects/european-offshore-wind-deployment-centre/>.

6 Adaptation Pathways

6.1 CMU Policies

Delivery of adaptation actions relies in a clearly defined management policy for each CMU. Fundamental to this is Aberdeenshire Council's Coast Protection Policy⁹. Here the policy statement highlights, that provision of new coastal protection works will only be considered subject to a positive benefit cost ratio and securing appropriate contributions from beneficiaries. Neither of these conditions have been satisfied during Phase 0 so the Policies for each CMU will only be established to set the initial direction of travel, not outline how this will be achieved.

Management policies have been classified based on the Scottish Government guidance into five categories. These will form the basis for development and delivery of the adaptation pathways.

1. **No Active Intervention** - Do nothing.
2. **Maintain** - Where existing structures, owned by the Council exist.
3. **Protect** - Where existing structures exist, residential properties are at risk and there is potential for a positive cost benefit to be achieved.
4. **Enhance Natural Features** - Where realistic opportunities exist for NBS to serve as risk mitigation.
5. **Make Space** - Where land use opportunities mapping has identified areas for safeguarding or offsetting loss.

Policies have been set based on the information available, and presented above, to outline both the current approach and idealistic end outcome for each CMU. It should be noted that, at this stage in the CCAP process, Idealistic Outcome Policies are not definitive and, depending on future Triggers, Actions and investigations may change. They do however, provide an initial starting point for Adaptation Pathways to work towards.

Review of the characteristics and risk associated with each CMU led to the classifications and policies in Table 6-1. These were used to develop initial Adaptation Pathways, Triggers, and an associated Implementation Plan.

Table 6-1: Blackdog and Balmedie CMU categorisation.

CMU	Coastal Type	Risk	Initial Policy	Idealistic Outcome Policy
1	Natural	Risk	No Active Intervention	Enhance Natural Features
2	Natural	Risk	No Active Intervention	Make Space

⁹ Aberdeenshire Council (2024) Coast Protection Policy.

6.2 Adaptation Pathways

Development of Adaptation Pathways for each CMU are based on the classification presented above. This aims to provide a flexible approach to adaptation that works towards a defined and desirable end outcome for the CMU and CA.

Details of this outcome are however, not defined at this stage, and will ultimately be dependent on monitoring changes at the coast, or implementation or improvements in other areas that influence climate resilience e.g.

- Natural systems
 - Habitat.
 - Greenspace.
- Climate
 - Climate change guidance.
 - SEPA flood maps or risk assessments.
 - Coastal flood occurrence.
- Risk exposure
 - Change in defence condition.
 - Update to SEPA flood warning system
 - Erosion risk buffer exceeded.
 - Flood risk threshold exceeded.
- Socio-economics
 - Changes of asset ownership
 - Changes of land ownership
 - Community pressures

Adaptation Pathways for each CMU are presented in the following sections. How, when or if, this will be achieved is dependent on the identified Triggers being realised and the outcomes of the associated Actions.

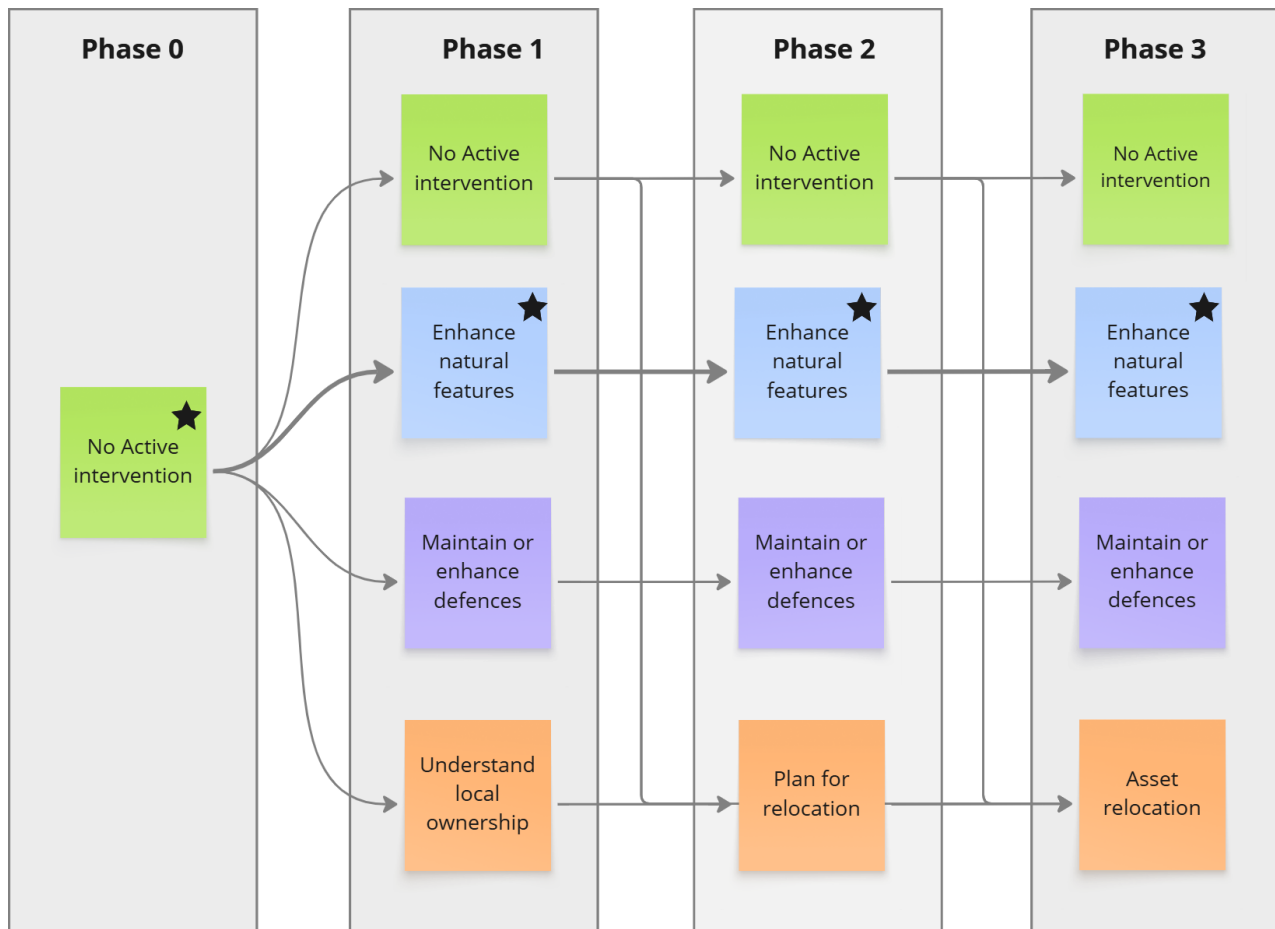
6.3 CMU 1 Natural coast with risk

CMUs 1 consists of a fully natural dune system, with no artificial coastal defences, it is described in more detail above in section 2.2.1. Given its classification as a natural coast with risk, the current policy (Phase 0) follows a No Active Intervention approach, allowing natural coastal processes to continue.

The NBS opportunities exercise developed potential to support adaptation through enhancing natural features. Considering the local geomorphology, projected erosion risk and the vulnerability of the core path, the proposed idealistic outcome policy is to enhance natural features. Actions aligned to this policy would aim to strengthen the resilience of the dune system while maintaining its natural character and preserving core path access.

Depending on the outcomes of Implementation Plan actions, the current management approach for CMU 1 may require review and potential revision. This may include consideration of making space policies to redesign or relocate the core path network to a

more sustainable alignment where enhancing natural features alone is insufficient to manage risk.



★ Preferred pathway

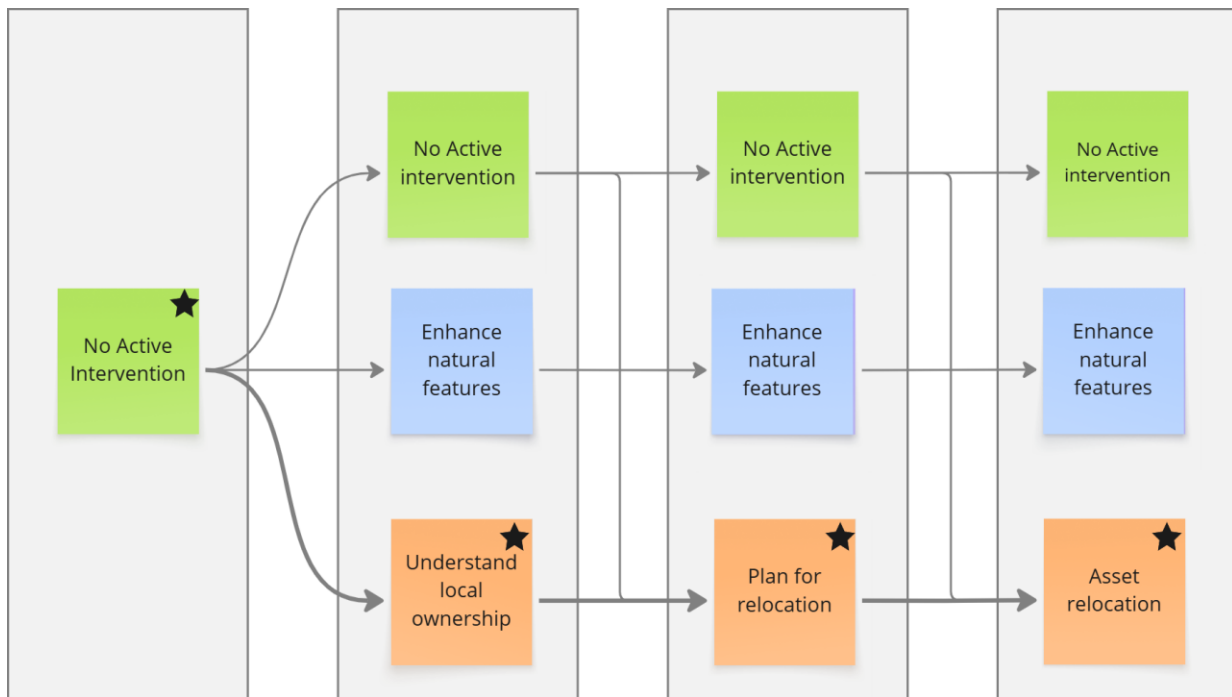
Figure 6-1: Identified preferred adaptation pathway for Blackdog and Balmedie CMU 1.

6.4 CMU 2 Natural coast with risk

CMU 2 consists of a fully natural dune system with no artificial coastal defences and is described in more detail in Section 2.2.1. It is classified as a natural coast and has been assigned an adaptive pathway for natural coasts with a predicted risk of erosion to a private golf course. Unlike CMU 1, there are no public receptors at risk within CMU 2; instead, the primary impacts of erosion are expected to affect the core paths along the coastline, as illustrated in Appendix A.1.

Given its classification as a natural coast with risk, the current policy (Phase 0) adopts a No Active Intervention approach, allowing natural coastal processes to continue without interference. Under this phase, no coastal or erosion risk management interventions are planned by Aberdeenshire Council. To progress to Phase 1 of the adaptive pathway, a predefined trigger must be met. Depending on the outcomes of any Implementation Plan actions, this may or may not lead to a revision of the current management approach for

CMU 2. The preferred pathway here has an end outcome of making space which may result in the re-design or relocation of the core path network in a more sustainable location.



★ Preferred pathway

Figure 6-2: Identified preferred adaptation pathway for Blackdog and Balmedie CMU 2.

7 Adaptation process

7.1 Implementation Plan

To support the delivery of the Adaptation Framework, a single Implementation Plan is applied across the entire CA, with a set of generic triggers and actions relevant to all CMUs. Since both CMUs are under the same Implementation Plan and share the same conditions, specific triggers and actions are assigned based on the Risk Assessment. The outcomes of the Implementation Plan are then linked to the Adaptation Pathway specific to each CMU.

Delivery of the Implementation Plan has three stages (Figure 7-1):

1. Monitoring and Triggers (section 7.2)
2. Actions (section 7.3)
3. Phase 0 Actions (section 7.4)

The outcome of the Implementation Plan determines what direction will be followed within the Adaptation Pathway when moving to a new phase.

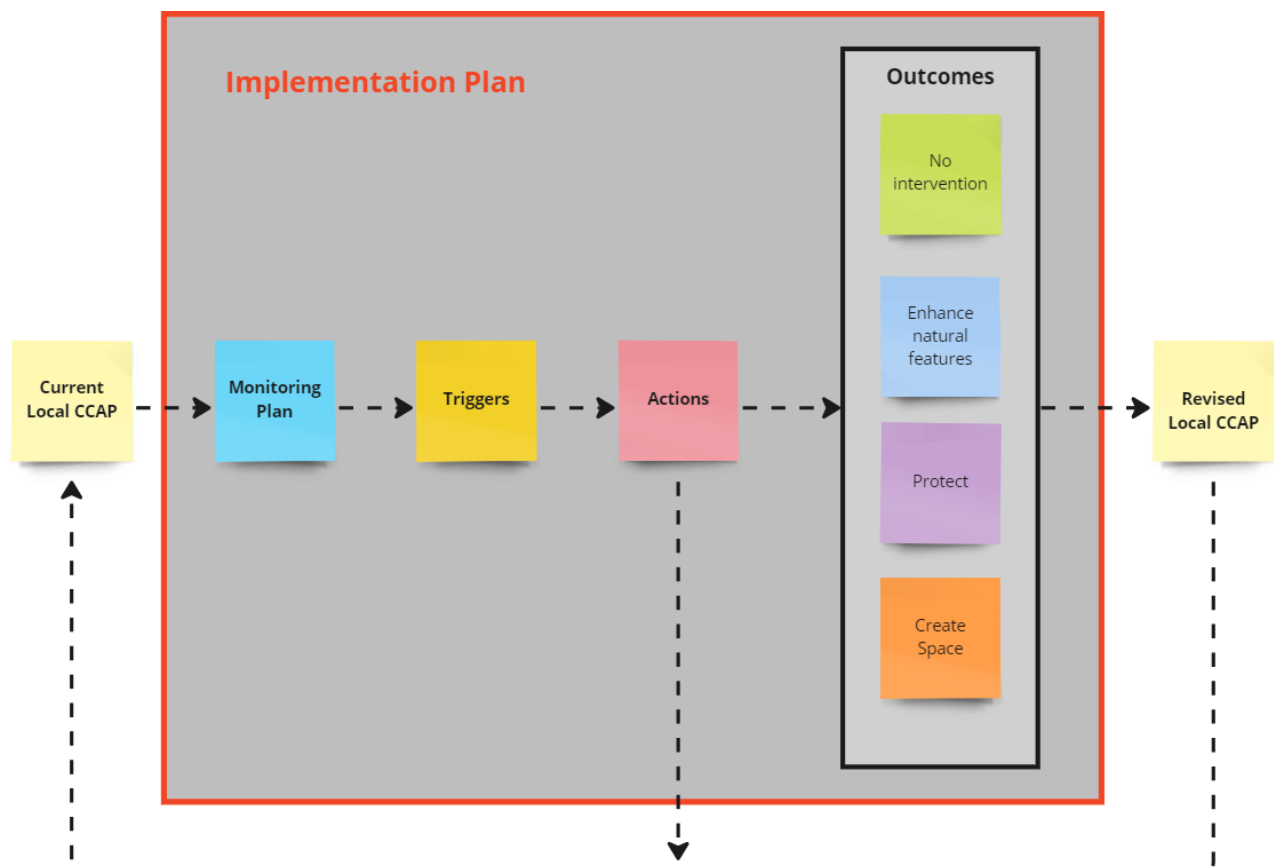


Figure 7-1: Implementation Plan

7.2 Monitoring and Triggers

7.2.1 Monitoring

Triggers are realised through monitoring of available data that informs risk of flooding and erosion. Triggers signal the requirement to deliver the Implementation Plan, which may lead to a review of the Risk Assessment and potentially change to the Adaptation Pathway.

Triggers are categorised as:

- Natural systems triggers.
- Climate triggers.
- Risk exposure triggers.
- Socio-economic triggers.

These are subsequently grouped into categories with each requiring a plan for monitoring within the CA:

- Third party data and information
- Aberdeenshire Council data and information
- Aberdeenshire Council monitoring
- External pressure

7.2.2 Trigger Classification

Classification of the triggers falls into two parts.

1. Generic triggers applicable to the entire CA.
2. Bespoke triggers applicable to individual CMUs.

Climate, natural system, and socio-economic triggers are generic for the whole CA, but risk exposure triggers related to physical flooding, erosion and overtopping thresholds are specific to each CMU. For the Blackdog and Balmedie CA these are summarised in Table 7-2.

Effective review of these requires development of a monitoring plan of risk at each CMU as follows:

- CMU 1: monitoring of erosion risk.
- CMU 2: monitoring of erosion risk

7.2.3 CMU specific erosion triggers

Where there is risk of erosion, the distance from the asset at risk to the coast is used to define the Trigger. For properties, roads and other features, the coast is defined by the present day MHWS position in Dynamic Coast. Assets considered at risk from erosion include:

- Residential properties.
- Key roads.
- Core paths.

To note, if two assets are in the same location (e.g. a road and property) only the most seaward asset is used to define the Trigger for that CMU.

As with the other CMU-specific triggers, a two-level approach is defined using buffers around the asset at risk. The associated action is, again, dependent on the consequence and asset at risk.

Erosion buffer distances (metres) for each level are defined as follows:

- **Residential properties**
 1. Maximum of historic erosion rate multiplied by 20 or 20m.
 - Increase monitoring and plan for assessment.
 2. Maximum of historic erosion rate multiplied by 10 or 10m.
 - Undertake assessment and plan for intervention.
- **Roads and other features**
 1. Maximum of historic erosion rate multiplied by 5 or 5m.
 - Increase monitoring and plan for assessment.
 2. Maximum of historic erosion rate multiplied by 2 or 2m.
 - Undertake assessment and plan for intervention.

Level 2 Erosion triggers have been met for core path (04) in CMU 1 (Table 7-1). Locations of all assets used for erosion triggers are shown in Figure 7-2, and Appendix A.1.

Table 7-1: CMU-specific erosion triggers for Blackdog and Balmedie properties, roads and features.

CMU	Maximum historical change rate (m/year)	Present-day distance of core path to coast (m)		Erosion trigger level 1: Coast X m from road	Erosion trigger level 2: Coast X m from road
1	6.0	Core path (04)	4.0	30.0	12.0
CMU	Maximum historical change rate (m/year)	Present-day distance of Property to coast (m)		Erosion trigger level 1: Coast X m from property	Erosion trigger level 2: Coast X m from property
1	3.6	RP	110	72.0	36.0

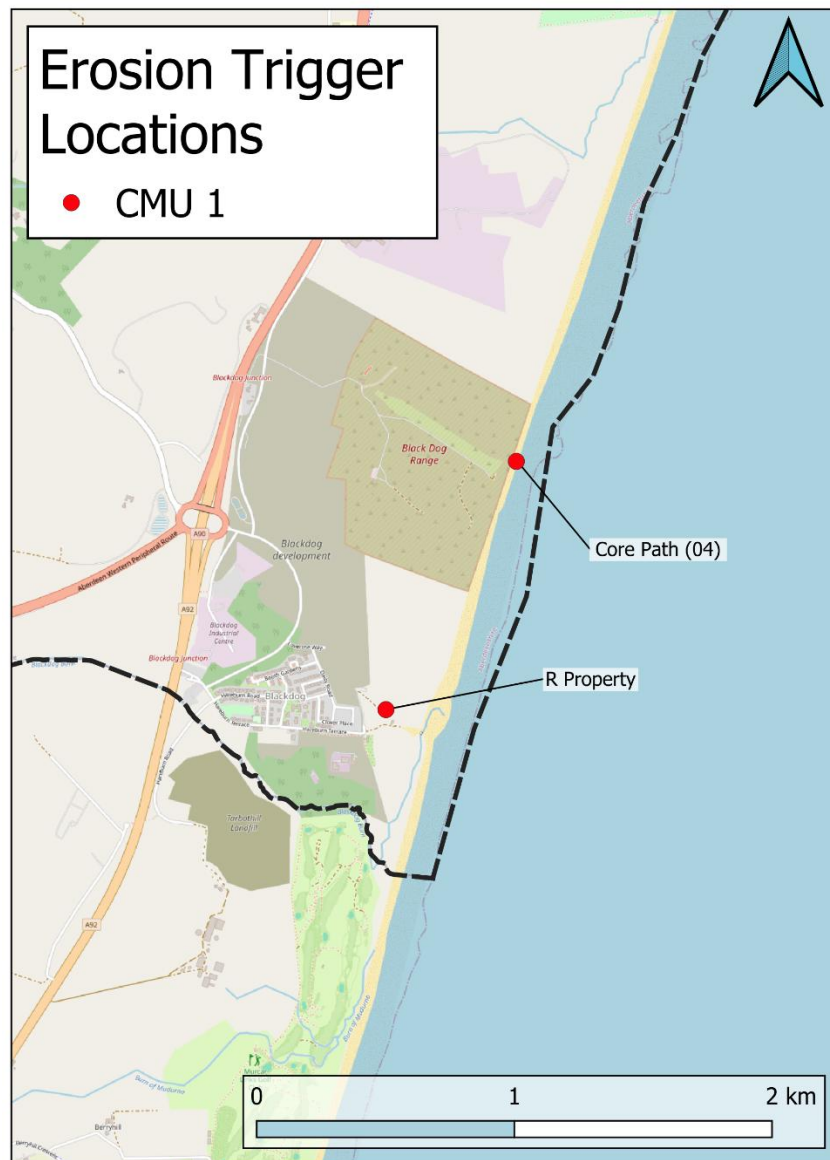


Figure 7-2: CMU 1 erosion locations

7.3 Actions

Actions, like Triggers, can also be applied to the entire CA, or to specific CMUs where the risk of flooding and/or erosion is identified. Actions will be specific to CMUs where, for example, a coastal defence is present; a natural protective feature is present; the risk of flooding/erosion is localised; assets are at risk of flooding/erosion.

Actions applicable to all and specific CMUs in Blackdog and Balmedie CA have been identified in Table 7-2.

Review risk assessment:

- Involves a review of available data and associated risk assessment. Increased monitoring, planning, and implementing an assessment, and

planning for intervention because of the erosion and flooding triggers are included in the review risk assessment action.

Community engagement:

- **Places:** Involves local groups, such as Councillors and community groups.
- **Practice:** Involves third party stakeholders, such as SEPA, Scottish Government, Nature Scot etc.
- **Asset:** Includes private defences harbours and utilities specific to defended or hybrid CMUs.

Post flood data collection:

- Involves community engagement, surveys, photographs etc.

New risk assessment:

- Following a review of the current risk assessment and/or community engagement, a new risk assessment may be required. Should a new assessment be deemed necessary this should follow appropriate guidance¹⁰ and include all necessary components to develop a preferred Adaptation Pathway and associated Action Plan for delivery. E.g. risk, economics, social, environment, engineering, land use planning etc.

Actions bridge the gap between Triggers and Outcomes and define what processes need to be implemented before the most appropriate Outcome is recognised and delivered for each CMU. Actions linked to specific triggers and relevant Aberdeenshire CMU is included in Table 7-2.

Table 7-2: Triggers, trigger categories and associated actions for each Blackdog and Balmedie CMU.

Category	Trigger	Action	Blackdog and Balmedie CMU
Natural Systems	Changes to habitat	Community engagement (places)	All
	Changes to greenspace	Community engagement (places)	All
Climate	Update to climate guidance	Review risk assessment Community engagement (practice)	All
	Update to SEPA flood maps	Review risk assessment Community engagement (practice)	All

¹⁰ Scottish Government. 2016. Flood protection appraisals: guidance for SEPA and responsible authorities <https://www.gov.scot/publications/guidance-support-sepa-responsible-authorities/pages/2/>

Category	Trigger	Action	Blackdog and Balmedie CMU
	Coastal flood occurrence	Review risk assessment Community engagement (places, asset) Post flood survey	All
Risk exposure	Defence condition	Community engagement (asset)	None
	Update to SEPA flood warning	Review risk assessment Community engagement (places, practice)	All
	Erosion buffer exceeded	Review risk assessment Community engagement (places)	CMU 1
	Flood risk threshold exceeded	Review risk assessment Community engagement (places)	None
	Update to Dynamic Coast	Review risk assessment Community engagement (practice)	All
Socio-economic	Changes of asset use	Community engagement (asset)	All
	Changes of asset ownership	Community engagement (asset)	All
	Community pressure	Review risk assessment Community engagement (places)	All

7.4 Phase 0 Actions

Phase 0 Actions require immediate attention and have been identified by associated triggers realised through the development process of this initial CCAP for Blackdog and Balmedie. These are outlined below. All Triggers realised at Level 2 mean that intervention should be planned for in the short-term. While the policies developed here can help steer this, the ultimate form of the intervention (e.g. dune enhancement or relocation) requires a specific assessment in collaboration with the wider CCAG.

- CMU 1 (Core path 04)

- Trigger: Erosion risk threshold exceeded (level 2)
- **Action:** Undertake assessment and plan for intervention.

As the Implementation Plan is applied at CMU level, the ultimate outcome is dependent on the CMU and the associated Adaptation Pathway. Table 6-1 summarises the general and specific CMU outcomes for the Blackdog and Balmedie CA.

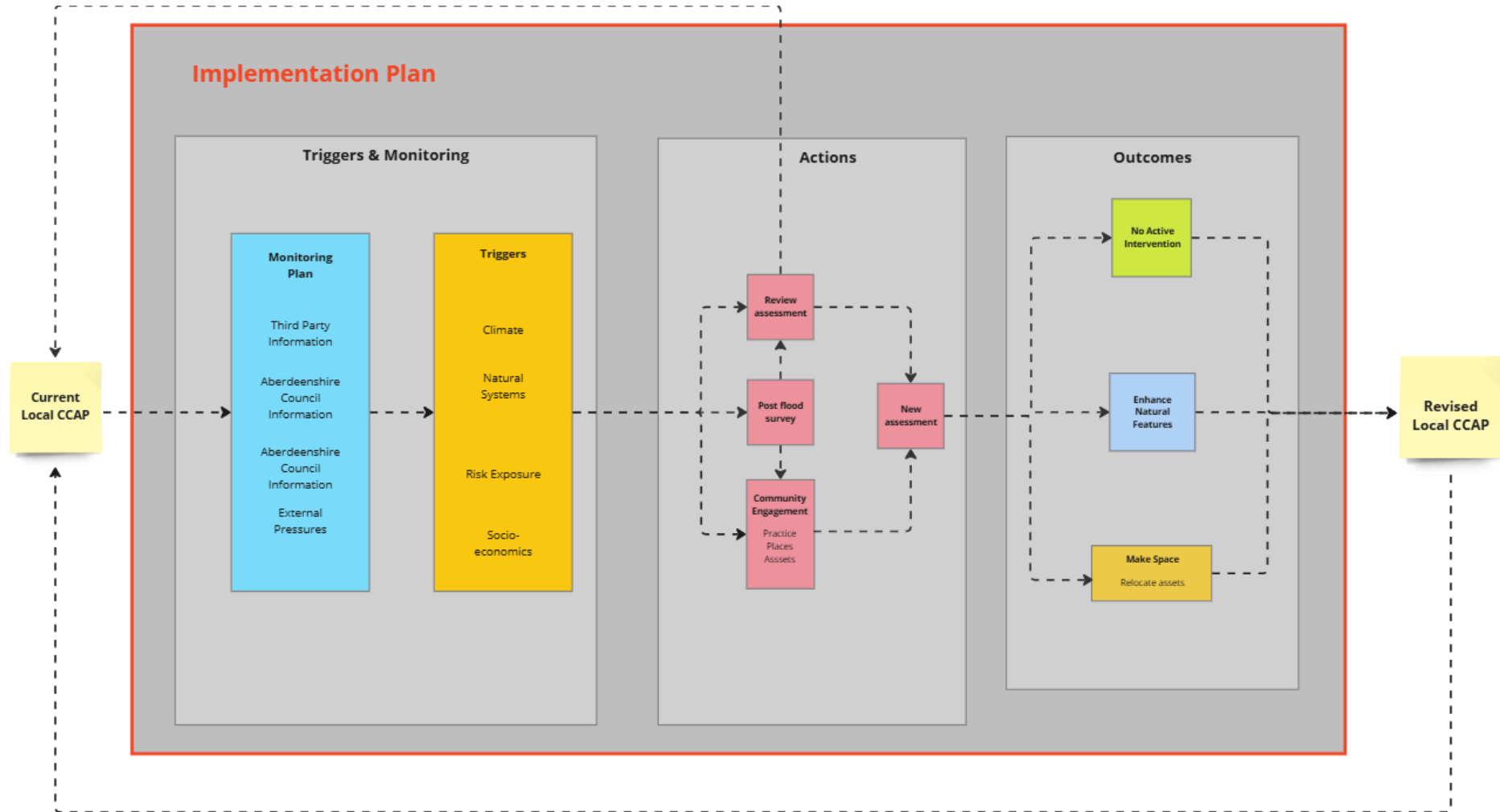


Figure 7-3: Example Implementation Plan for Blackdog and Balmedie CCAP

7.5 Example applications

Figure 1-1 provides a schematic describing an example application of the Implementation Plan and how it fits in with the wider Adaptation Framework. The red box highlights the processes described in this iteration of the CCAP.

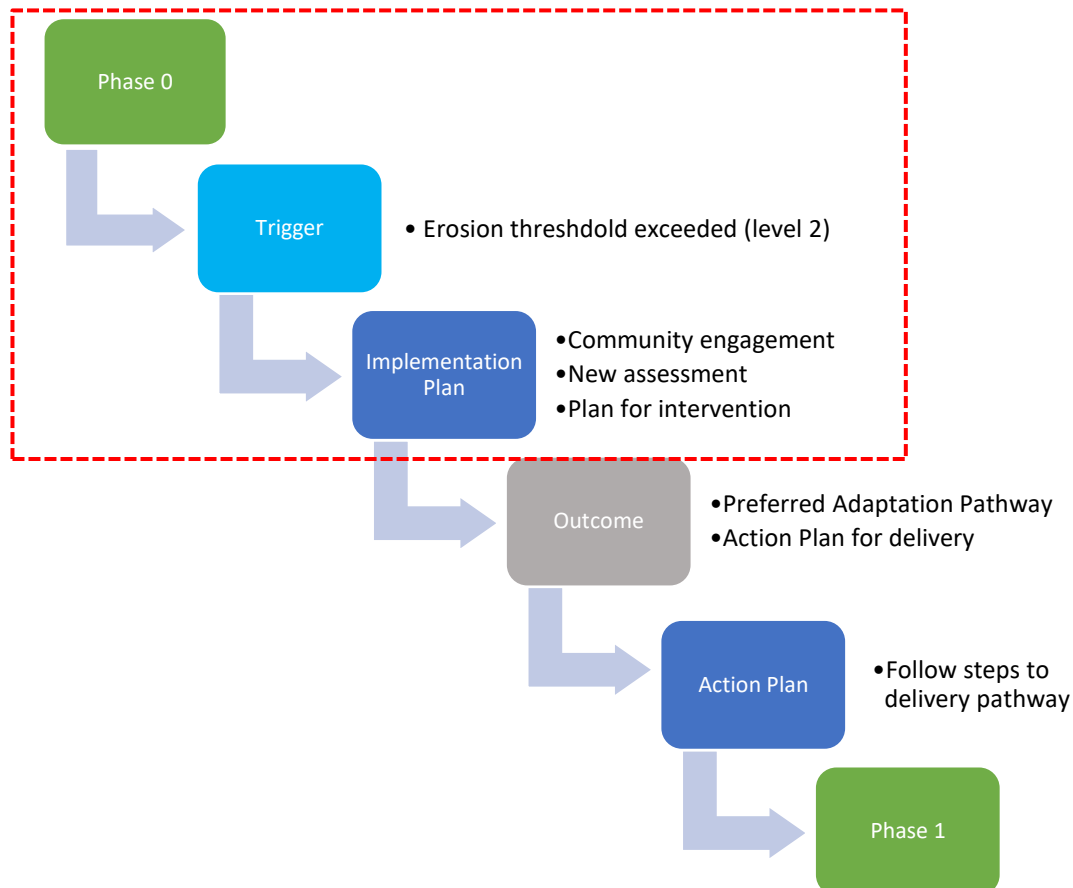


Figure 7-5: Example application of Phase 0 to Phase 1 of the adaptation process and how the Implementation Plan works with Adaptation Pathways and Action Plans.

7.6 Supporting Steps and Proactive Actions

The nature of adaptation means that future decisions and directions are unknown and will be affected by external changes not necessarily under Aberdeenshire Council's influence. It is critical that proactive supporting steps and Proactive Actions are undertaken to enable effective decision making in the future. Proactive Actions are defined as those whereby there should only be benefit. Undertaking these can therefore only have a positive impact on supporting adaptation or increasing resilience. At this stage in the adaptation planning process eight such actions have been identified. These have been developed focusing on the key pillar identified previously and through review and understanding of key knowledge gaps. They therefore aim to close these knowledge gaps at this stage and support alignment with wider aspects of the adaptation plan for the region. A summary of these

actions is provided in Table 7-3. These are designed to complement the wider Proactive Actions identified in the Regional CCAP.

Table 7-3: Local Proactive Actions

Action	Details	Pillars	
1	Undertake dune enhancement in CMU 1 and CMU 2 and locations with vulnerable core paths	Working with Natural Processes	
2	Develop modelling framework to support future assessments	Working with Natural Processes	
3	Identify landownership and to support safeguarding and land-based planning for CMU with Make Space outcome policies	Place Making	
4	Establish coordinated and consistent beach monitoring plan for Natural CMUs	Monitoring Change	
5	Undertake critical third-party sector engagement to quantify wider economic impacts	Community and Engagement	
6	Identify landownership and to support safeguarding and land-based planning for CMU with Make Space outcome policies	Place Making	
7	Integrate future erosion projections into Local Development Planning to establish Coastal Change Management Areas	Place Making	

Action	Details	Pillars	
8	Investigate impact of future erosion on historic landfill sites and develop risk mitigation plan	Working with Natural Processes	

8 Summary and Next Steps

8.1 Approach

This document presents the local CCAP for the Blackdog and Balmedie CA. It is the first iteration and will be subject to ongoing review and update to effectively guide the adaptation process. The approach for developing the Plan makes use of available, national information on coastal flood and erosion risk and combines these with relevant local datasets.

Adaptation in Aberdeenshire has been steered by relevant published documentation and the Scottish Governments interim guidance on CCAPs. These have been used to develop a Regional CCAP. This has been simplified into four key pillars of adaptation:

- 1. Working with Natural Processes**
- 2. Monitoring Change**
- 3. Community and Engagement**
- 4. Climate Resilient Placemaking**

This local Plan builds on the Regional Plan by focusing on these pillars to develop an Adaptation Framework that can effectively support Blackdog and Balmedie preparing for the impact that climate change will have on the coast. This will be delivered by following the Implementation Plan, presented here, that outlines triggers and associated actions to develop Adaptation Pathways and an Action Plan. This will happen when the process moves into Phase 1.

The following sections provide summaries of the key findings of this initial stage of the adaptation planning process.

8.2 Coastal Management Units and Risks

The Blackdog and Balmedie CA was subdivided into two CMUs. For each of these a refined assessment was undertaken to determine coastal type and associated current and future flood and erosion risk. These are summarised as:

- CMU 1 – Natural with Risk
- CMU 2 – Natural with Risk

8.3 Adaption Pathways

Each CMU has been assigned a generic Adaptation Pathway to ensure the effective implementation of this CCAP.

The adaptation journey is a multiphase, multiyear process and aims to transition communities into a more sustainable and resilient future. We are currently at **Phase 0**, meaning that no definitive preferred Adaptation Pathway and associated Action Plan have been developed. To move to **Phase 1** of the Adaptation Pathway, a trigger must be realised

that results in New Assessment and a preferred pathway and associated Action Plan must be identified:

1. Phase 0:
 - Development of the Implementation Plan
 - Delivery of Phase 0 Actions
 - Delivery of Phase 0 Proactive Actions
2. Phase 1:
 - Implementation Plan outcomes:
 - Preferred Adaptation Pathway
 - Action Plan for delivery
 - Delivery of Phase 1 Proactive Actions
3. Phase 2+:
 - Implementation Plan outcomes:
 - Preferred Adaptation Pathway
(Continue or revise Phase 1)
 - Action Plan for delivery
(Continue or revise Phase 1)
 - Delivery of Phase 2 Proactive Actions

While ultimately the Adaptation Pathways have a desired outcome, what that looks like and how it will be reached cannot be defined at this stage. Effective monitoring against the set triggers will enable the CCAP to evolve through Phases and support Aberdeenshire Council decision making to aim to achieve this end-outcome.

8.4 Implementation Plan

The Implementation Plan was developed by defining Triggers and setting Actions against these. Implementation of the Plan will result in end outcomes that will ultimately influence the direction of the Adaptation Pathways.

At this stage the pathways do not result in definitive end points. Triggers, while tangible, provide markers whereby Aberdeenshire Council will undertake actions, guided by the Implementation Plan. The Outcomes of these however, are unknown and the elements of the pathway in the future therefore cannot be defined.

As well as Actions that rely on Triggers being realised. This initial stage of the adaptation planning process has identified several knowledge gaps and opportunities for activities to be undertaken upfront. These are defined as Proactive, whereby undertaking these will only benefit and support Aberdeenshire's adaptation to coastal change.

In total, eight Proactive Actions have been set.

8.5 Next steps

Adaptation to coastal change will be a continual journey and it is therefore important that the process is ongoing. Here, the following key steps require implementing by Aberdeenshire Council to support this journey and follow CCAP:

- Implement internal governance processes to review and monitor Triggers.
- Deliver local Proactive Actions.

Critical to the Blackdog and Balmedie CA is development of an improved understanding of erosion risk to newly developed areas. Dynamic Coast predicts these to be at risk. Initially these needs incorporating immediately into future planning and development decisions through establishment of a CCMA and associated development policies in the LDP. Upon completion of the Proactive Actions, this should be refined and updated through collaboration across the CCAG.

A Triggers

A.1 Erosion Trigger profiles

Table A- 1: Blackdog and Balmedie erosion triggers.

CMU	Asset	Trigger Met	Erosion Trigger
1	RP	No	
1	Core path (04)	Yes	

Offices at

Bristol
Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Leeds
Limerick
Newcastle upon Tyne
Newport
Peterborough
Portsmouth
Saltair
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

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