Coastal erosion and flood risk management

Scottish Government
Riaghaltas na h-Alba
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13 CLIMATE ACTION | 14 LIFE BELOW WATER | 15 LIFE ON LAND

Key message

Scotland has £18bn of buildings and infrastructure within 50 m of the shoreline. Three-quarters of these assets are protected by natural defences (£13bn) such as sand dunes; compared with artificial defences (£5bn) such as sea walls. There have been a few new schemes since 2011. Rising sea levels, increased coastal erosion and erosion-enhanced flooding will progressively impact soft coastlines.

Dynamic Coast: Scotland's Coastal Change Assessment website

What, why and where?

Coastal erosion is a naturally occurring process which periodically affects soft shoreline. Coastal erosion and coastal flooding are interlinked and are considered jointly.

Flooding is the responsibility of the property owner. SEPA published the second National Flood Risk Assessment (NFRA) in December 2018. The NFRA identifies the areas at most risk of flooding and underpins flood response planning. Flood risk management strategies and local plans, prepared under the Flood Risk Management (Scotland) Act 2009 ensure that long-term proactive planning and investment decisions protect the areas at greatest risk of flooding. SEPA estimate that over 28,000 properties are at coastal flood risk.

Landowners are also responsible for protecting their property from coastal erosion. Local authorities have powers (but not obligations) under the Coast Protection Act 1949 to protect land from the sea and can fund coast protection work from their general capital grant from the Scottish Government.

Dynamic Coast, Scotland's national coastal change assessment, identified past and anticipated coastal changes (e.g. Figure 1) across the erodible coast. This project identified that three-quarters of the £18bn of buildings and infrastructure within 50 m of the shoreline are protected by natural defences (£13bn) such as sand dunes; compared with artificial defences (£5bn) such as sea walls.

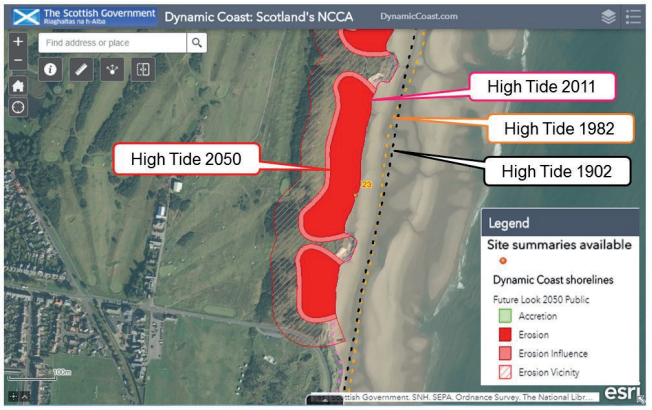


Figure 1:
Past and anticipated coastal changes at Montrose (Angus), based on the historic, recent and modern tide line (Mean High Water Springs). Source: Dynamic Coast.

For further information on this topic go to: https://marine.gov.scot/sma/assessment/coastal-erosion-and-flood-risk-management

Coastal protection schemes since 2011.

Three schemes have been completed without grant aid since 2011; these are at Kirkcaldy (2014), £9.0M, Johnshaven (2012) and Benbecula Airport (2018). Network Rail has also completed three to protect coastal railways at Langbank (2015), Craigendoran (2018/2019) and Stranraer (2019/20).

Flood protection schemes since 2011.

The Scottish Flood Defence Asset Database lists completed schemes as: Dundee Water front (2018) £6.5M and Kirkwall (2019) £1.1M.

One managed realignment scheme was completed (in 2018 at the RSPB reserve at Skinflats (Firth of Forth)). Here flood defences protecting previously claimed land have been breached to allow in tidal water, to re-initiate natural processes (Figure 2).

Contribution to the economy

Coastal protection and flood protection schemes do not in themselves contribute to economic Gross Value Added (GVA). Work under both coastal erosion and flood risk management can be viewed as preventative spend as they help limit damage to property, reduce business losses and protect livelihoods. Each project undergoes detailed cost benefit analysis to determine the best scheme option. The potential losses are categorised as:

- Residential and non-residential properties
- People

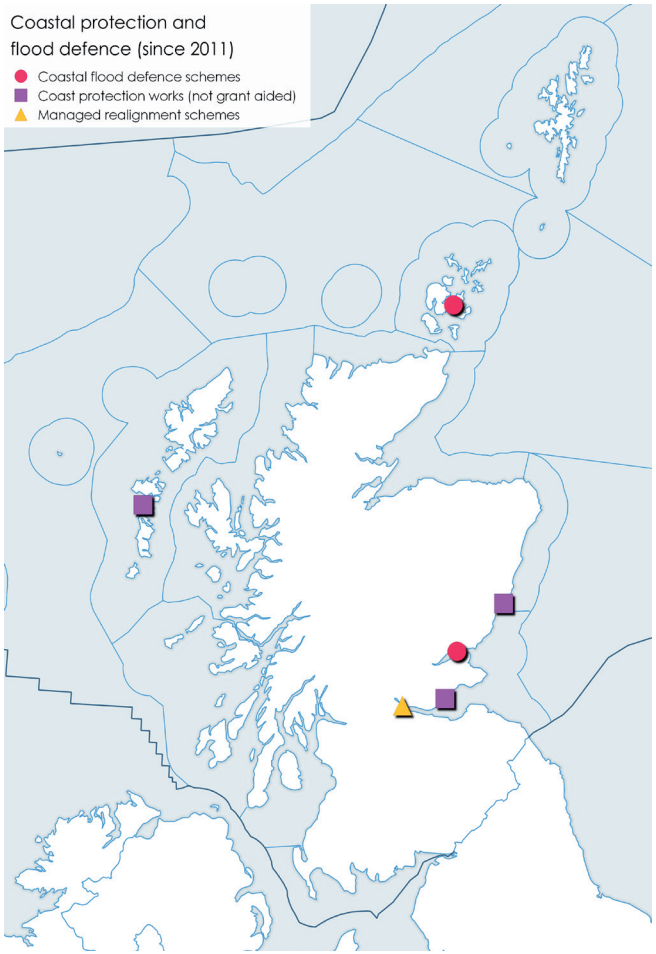


Figure 2:
Coastal protection and Flood protection scheme locations since 2011 (excludes schemes under development). Source: Marine Scotland, Scottish Government and SEPA.

- Community facilities
- Utilities assets
- Transport links
- Environmental designated areas
- Designated cultural heritage sites
- Agricultural land

For the flood protection schemes listed above SEPA estimate, for various risk levels, the anticipated risk to people and damage likely to be incurred without flood and coastal defence (see example on SEPA web site). These damages are used to balance the cost of mitigating flooding against the losses that could be incurred. These are then used to estimate the potential economic benefit of the scheme.

For example, the Dundee flood protection scheme, completed in 2018, costing £6.5m, protects the £1 billion water front development as well as homes and roads between the docks and the airport.

The damage mitigated by a flood scheme does not always outweigh the estimated costs of construction and this must be assessed for each option.

Coastal erosion and flood risk are interlinked. Both can have a devastating impact on the lives, businesses and communities of those affected. People whose homes are flooded may need to be in temporary accommodation for many months. The impact on local businesses can be great and in some cases businesses never re-open after a flood.

It has not been possible to determine a trend since the previous assessment, even at the national level, as budgets are not always declared and schemes can take several years to implement.

Following an agreement with COSLA (Convention of Scottish Local Authorities) in 2016 Scottish Government guarantees a minimum of £42M

each year until 2026 to fund prioritised flood risk management actions, including flood schemes. This agreement gives local authorities certainty to deliver the actions set out in the Local Flood Risk Management Plans. Local Authorities can also allocate additional resources from within their overall funding.

Examples of socio-economic effects

- Protection of people, property, businesses and infrastructure.
- Conserving or enhancing amenity value of coastal land.
- Options such as salt marsh habitat creates defence with lower maintenance cost.
- Maintenance and sustainability in the face of sea level and climate change.
- Disruption during construction.
- May encourage development in low lying areas.

Pressures on the environment

An OSPAR agreed list of marine pressures is used to help assessments of human activities in the marine environment. The marine pressure list has been adapted for use in Scotland via work on the Feature Activity Sensitivity Tool (FeAST). Coastal erosion and flood risk management activities can be associated with 20 marine pressures – please read the pressure descriptions and benchmarks for further detail.

Forward look

SEPA's 2018 national flood risk assessment estimates that with climate change the number of properties at risk from coastal flooding is expected to increase to over 54,000 properties by 2080s.

Evidence from the Dynamic Coast project helps identify and anticipate coastal changes to better adapt to sea level rises of up to 0.9 m forecast along the east coast by the end of the century.

The anticipated increase in extent and rate of coastal erosion due to increased sea level rise is being investigated by the second phase of Dynamic Coast research; this will be published in 2020.

Findings from the Dynamic Coast 1 show that:

- if recent erosion rates were to continue in the future, by 2050 at least 50 residential and non-residential buildings, 1.6 kms of railway, 5.2 kms of road and 2.4 kms of clean water network as well as significant areas of runways, cultural and natural heritage sites are expected to be affected by coastal erosion. These numbers are likely to be underestimates.
- if erosion rates increase in the future, as expected with climate change, Dynamic Coast and SEPA's National Flood Risk Assessment are likely to underestimate the extent of assets at risk from future coastal erosion and associated coastal flooding. Large numbers of assets are sited close to potentially erodible coasts (including 30,000 buildings, 1,300 km of roads and 100 kms of railway lines).

Economic trend assessment

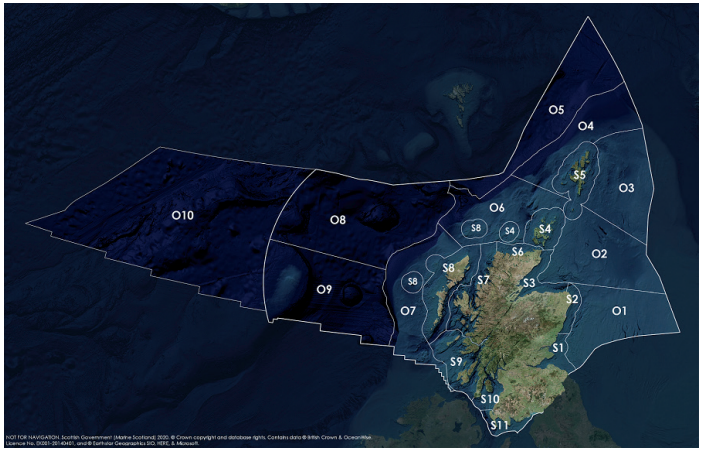
Trend assessments are not applicable to coast protection and flood defence. While the quantity and location of projects changes, there are no discernible time series either at the national or regional level that provide a meaningful indication for progress. Trend assessment is made more difficult as the risks posed by climate change and continued development pressure mean there is an increasing risk of assets being damaged from coastal flooding and coastal erosion.

Status and trend assessment legend

Status assessment (for Clean and safe, Healthy and biologically diverse assessments)		Trend assessment (for Clean and safe, Healthy and biologically diverse and Productive assessments)	
	Many concerns		No / little change
	Some concerns		Increasing
	Few or no concerns		Decreasing
	Few or no concerns, but some local concerns		No trend discernible
	Few or no concerns, but many local concerns		All trends
	Some concerns, but many local concerns	**Confidence assessment**	
	Lack of evidence / robust assessment criteria	**Symbol**	**Confidence rating**
	Lack of regional evidence / robust assessment criteria, but no or few concerns for some local areas		Low
	Lack of regional evidence / robust assessment criteria, but some concerns for some local areas		Medium
	Lack of regional evidence / robust assessment criteria, but many concerns for some local areas		High

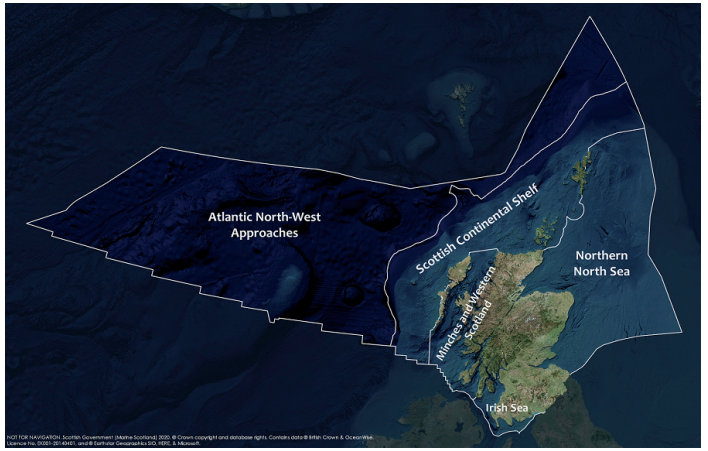
Overal confidence

Assessment regions

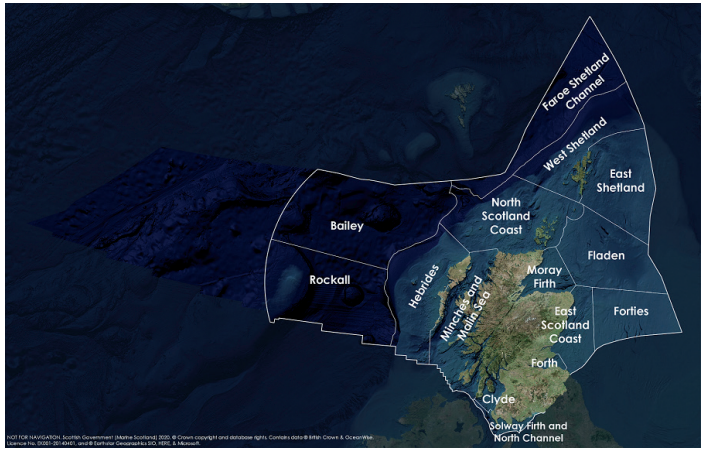


The Scottish Marine Regions (SMRs; S1 – S11) and the Scottish Offshore Marine Regions (OMRs, O1 – O10)

Key: S1, Forth and Tay; S2, North East; S3, Moray Firth; S4 Orkney Islands, S5, Shetland Isles; S6, North Coast; S7, West Highlands; S8, Outer Hebrides; S9, Argyll; S10, Clyde; S11, Solway; O1, Long Forties, O2, Fladen and Moray Firth Offshore; O3, East Shetland Shelf; O4, North and West Shetland Shelf; O5, Faroe-Shetland Channel; O6, North Scotland Shelf; O7, Hebrides Shelf; O8, Bailey; O9, Rockall; O10, Hatton.



Biogeographic, Charting Progress 2 (CP2) Regions. These have been used as the assessment areas for hazardous substances.



Scottish Sea Areas as used in Scotland's Marine Atlas 2011. These are sub divisions of the biogeographic, or Charting Progress 2 (CP2), Regions.

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marinescotland

NatureScot
Scotland's Nature Agency
Buidheann Nàdair na h-Alba

JNCC
Joint Nature Conservation Committee

SEPA
Scottish Environment Protection Agency

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