

Flood Risk Management Strategy

Outer Hebrides Local Plan District

This section provides supplementary information on the characteristics and impacts of river, coastal and surface water flooding. Future impacts due to climate change, the potential for natural flood management and links to river basin management are also described within these chapters.

Detailed information about the objectives and actions to manage flooding are provided in Section 2.

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3.1 Introduction

In the Outer Hebrides Local Plan District, coastal flooding is reported across three distinct coastal areas. River flooding and surface water flooding are reported across the whole Local Plan District.

A summary of the number of properties and Annual Average Damages from river, coastal and surface water flooding is outlined in Table 1.

	Total number of properties at risk ¹	Annual Average Damages	Local authority
River catchments			
Outer Hebrides river catchment group	90	£470,000	Comhairle nan Eilean Siar
Coastal flooding			
Lewis and Harris coastal area	130	£600,000	Comhairle nan Eilean Siar
North Uist and Berneray coastal area	30	£260,000	Comhairle nan Eilean Siar
Benbecula, South Uist and Barra coastal area	150	£930,000	Comhairle nan Eilean Siar
Surface water flooding			
Outer Hebrides Local Plan District	40	£59,000	Comhairle nan Eilean Siar

Table 1: Summary of flood risk from various sources within the Outer Hebrides Local Plan District

¹ Total number of residential and non-residential properties at risk of flooding

3.2 River flooding Outer Hebrides Local Plan District

This chapter provides supplementary information on river flooding at the catchment level. It provides an overview of the catchment's natural characteristics, flood risk and the existing actions to manage flooding. It outlines the likely impact of climate change and the potential for natural flood management.

Detailed information about the objectives and actions to manage flooding are provided in Section 2.

Catchment overview

Much of the Outer Hebrides (Figure 1) is characterised by bog, heather, rough grassland and freshwater lochs connected by small watercourses. The islands have a mild marine climate with an annual average rainfall of around 1,100mm. There are no major rivers. However, there are numerous smaller rivers and burns that drain the highland areas into lochs or directly to the sea. There are more than 7,500 freshwater lochs in the Outer Hebrides, mostly concentrated on Lewis and in the Uists.

Since the early 19th century, artificial drainage systems have modified natural drainage patterns to produce a complex system of freshwater lochs, ditches, stream connections and diversions. This was designed to drain large areas of wet marsh to create a greater quantity and quality of agricultural land. Flood gates on both the east and west coasts allow fresh water to drain to the sea during low tide whilst preventing the ingress of sea water at high tide.

The machairs of the Uists and Barra have a close association with the water table. Winter rainfall raises the level of the water table on the machair leading to localised flooding in low areas and forming inland lochs, often just behind the beach dune ridge.

Much of the drainage system for the Uists and Barra is below the level of the mid to high tide level and the outfalls have floodgates that prevent sea water entering the system. During prolonged periods of higher sea levels, for example due to low atmospheric pressure, the time available for water to drain through the floodgates is reduced leading to more water being stored in lochs and on the land, which in turn leads to an increased risk of flooding.

There are eight Potentially Vulnerable Areas:

- Ness (02/01)
- Stornoway (02/02)
- Southern Harris (02/03)
- Lochmaddy and Trumisgarry (02/04)
- North Uist (02/05)
- Benbecula (02/06)
- Lochs Bi and Druidibeag (02/07)
- Bornish to Boisdale (02/08)

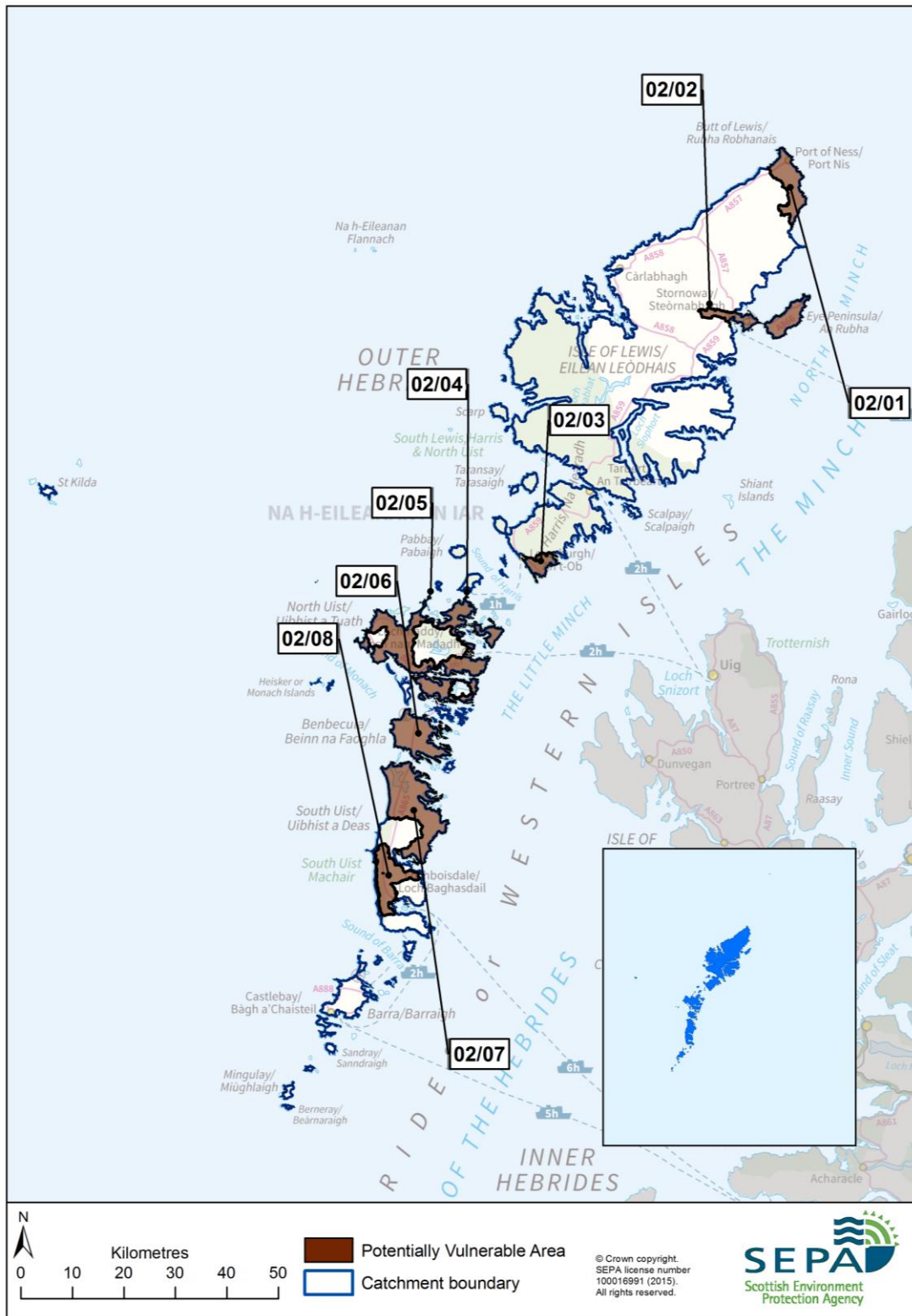


Figure 1: Outer Hebrides river catchments area and Potentially Vulnerable Areas

Flood risk in the catchment

There are approximately 60 residential properties and 30 non-residential properties at risk of river flooding in the Outer Hebrides. Approximately 95% of residential and 47% of non-residential properties at risk of flooding are located within the Potentially Vulnerable Areas.

Main areas at risk

The main areas at risk of river flooding are shown in Table 1, which also includes an estimate of the Annual Average Damages from river flooding for each area.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Bornish to Boisdale	20	£110,000
Benbecula	20	£74,000
Stornoway	10	£43,000

Table 1: Main areas at risk of river flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the catchment are estimated to be £470,000. This accounts for approximately 20% of the total damages for this Local Plan District from all sources of flooding. The damages are distributed as follows:

- 45% residential properties (£210,000)
- 19% roads (£88,000)
- 17% agriculture (£77,000)
- 12% non-residential properties (£58,000)
- 6% emergency services (£27,000)
- 2% vehicles (£9,300)

Figure 2 shows the location of Annual Average Damages from river flooding across the area.

Table 2 shows the approximate numbers of further infrastructure assets which are at risk of river flooding within this catchment.

	Number at risk	Further detail
Community facilities	0	n/a
Utility assets	0	n/a
Roads (excluding minor roads)	240 locations	Notably the A859, A857, A865, A867, B892 and B893.
Railway routes	n/a	n/a
Agricultural land	54km ²	n/a

Table 2: Infrastructure and agricultural land at risk of river flooding

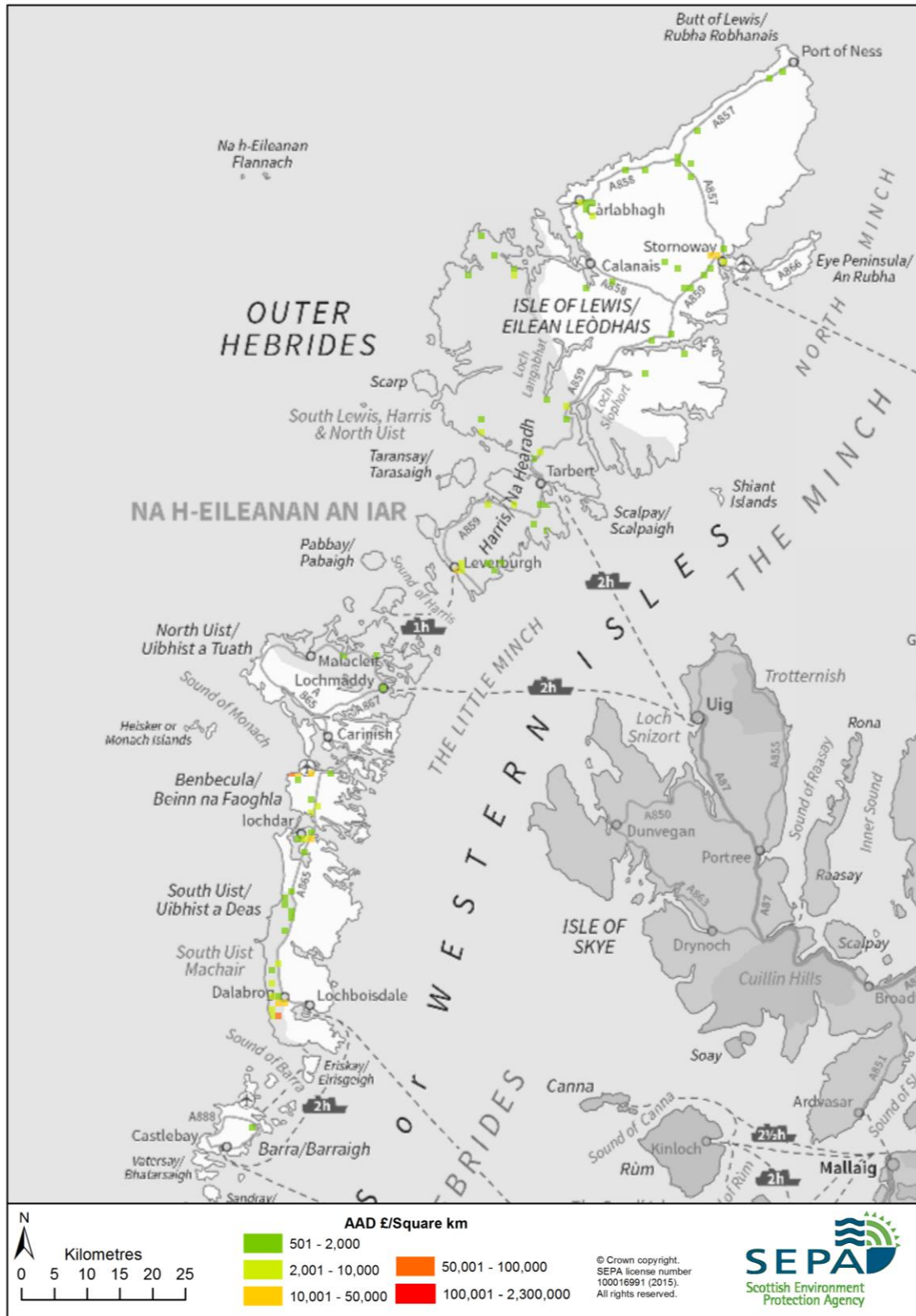


Figure 2: Annual Average Damages from river flooding

Designated environmental and cultural heritage sites at risk

There are 21 cultural heritage sites at risk of river flooding. These sites include scheduled monuments and listed buildings.

Approximately 163km² of designated environmental area is at risk of river flooding across the Outer Hebrides, including Special Areas of Conservation, Special Protection Areas and Sites of Special Scientific Interest. The sites affected include Balranald Bog and Loch nam Feithean, Gress Saltings, Langavat, Lewis Peatlands, Luskentyre Banks and Saltings, Mointeach Scadabhaigh, Obain Loch Euphoirt, South Uist Machair and Stornoway Castle Woodlands. These designated sites are quite resilient to existing levels of river flooding although ground nesting birds can be adversely affected.

History of river flooding

There have been a number of localised floods from rivers and lochs, some of which occurred during periods of tidal surge combined with high rainfall. This resulted in flooding of land upstream of river estuaries, such as at Bayhead, Stornoway.

In the Uists, periods of heavy rainfall are particularly common during winter. This can result in a rise in the levels of lochs and also groundwater, causing persistent localised flooding. Low pressure systems associated with heavy rainfall also raise sea levels, which inhibit drainage of water from the low lying land to the sea leading to further increases in the water levels locally.

Further detail about the history of flooding in this area is available in the relevant PVA chapter of this document.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1 of this document.

Existing actions that are in place to manage flood risk and that are in addition to the information presented in Section 2 are described below.

Awareness raising campaigns and community groups

There are two community flood action groups, the Lochdar Flood Action Group and the Middle District Flood Action Group. Both were formed in the immediate aftermath of the January 2005 coastal flooding. Public meetings and workshops have been held in recent years to discuss flooding and coastal erosion issues, particularly in Benbecula and South Uist. These events have been well attended reflecting the importance of coastal issues to the local population and the willingness of local people to be involved in decision making and implementation of schemes.

The management of levels in lochs, connecting channels and the outlets to the sea are crucial in maintaining a lowered groundwater level. Maintenance arrangements for these features rest primarily with the land managers.

Climate change and future flood risk

The UK Climate Projections (UKCP09) predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall. The predicted increase in rainfall and river flows may increase the potential for river flooding.

Under the UKCP09 high emissions scenario for 2080, average peak river flows for the Outer Hebrides catchment may increase by 56%¹. This would potentially increase in the number of residential properties at risk of river flooding from approximately 60 to 70, and the number of non-residential properties from approximately 30 to 40.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (<http://www.sepa.org.uk/environment/water/flooding/flood-maps/>). The maps indicate the potential for runoff reduction, floodplain storage and sediment management. They show areas where natural flood management could be effective and where further detailed assessment has taken place to identify where local authorities could include natural flood management as part of flood risk management schemes and studies.

Runoff reduction

Whilst the majority of the islands show potential for runoff reduction, no locations were identified where runoff reduction could practically contribute to significantly reduce river flooding in the Potentially Vulnerable Areas. Opportunities may exist however to make use of natural flood management techniques to assist with localise flooding issues.

Floodplain storage

There are some areas with potential for floodplain storage scattered throughout the Uists and in Benbecula, including close to Balivanich and on South Uist. The unique water level management situation in the Uists needs to be taken into account to determine the practicalities and effectiveness of these flood risk management solutions. No locations were identified where floodplain storage could practically contribute to significantly reduce river flooding in the Potentially Vulnerable Areas. Opportunities may exist however to make use of natural flood management techniques to assist with localise flooding issues.

Sediment management

High rates of sediment deposition can contribute to flooding by reducing the capacity of watercourses to convey water particularly where they pass under bridges and through culverts. Actions to reduce the supply of sediment at source by restoring

¹ From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

sections of river bank may offer opportunities to reduce flood risk in areas where it currently accumulates.

No locations were identified where sediment supply could be practically managed at source in a way that contributes to significantly reduce river flooding in the Potentially Vulnerable Areas. Opportunities may exist however to make use of natural flood management techniques to assist with localise flooding issues.

Within the complex drainage systems in the Outer Hebrides, the shallow gradient of watercourses that connect the lochs and drainage systems leads to deposition of fine sediment and the growth of vegetation in ditches and drains. This is removed to help maintain drainage and the flow of water.

3.3 Coastal flooding

Outer Hebrides Local Plan District

This section provides supplementary information on flooding for coastal areas. It provides an overview of the natural characteristics of the coast, a summary of flood risk within the coastal area and a brief history of flooding. It also outlines the likely impact of climate change and the potential for natural flood management.

Information about the objectives and actions to manage flood risk are provided in Section 2.

In the Outer Hebrides Local Plan District, coastal flooding is reported across three coastal areas (Figure 1).



Figure 1: Coastal areas within the Outer Hebrides Local Plan District

Coastal flooding Lewis and Harris

Coastal overview

The Lewis and Harris coastal area (Figure 1) has a coastline with a length of approximately 940km. It comprises the northern portion of the Outer Hebrides Local Plan District and includes the island of Lewis and Harris.

For the most part, the coast is rocky in nature comprising cliffs, reefs and rocky outcrops and with many inlets and sea lochs. Locally, shingle and sandy beaches form at the heads of inlets and in bays. Some of the sandy beaches are extensive, for example at Uig, Luskentyre and Borve on the west coast. On the west coast of Lewis in the district of Uig, machair grasslands are the predominant land form extending to around two kilometres inland from the coastline.

There are three Potentially Vulnerable Areas:

- Ness, Isle of Lewis (02/01)
- Stornoway, (02/02)
- Southern Harris (02/03)

Flood risk in the coastal area

Within the Lewis and Harris coastal area, there are approximately 40 residential properties and 90 non-residential properties at risk of coastal flooding. Approximately 40% of the residential and 73% of non-residential properties at risk in this coastal area are located within the three Potentially Vulnerable Areas, with the majority located in Stornoway (02/02).

Main areas at risk

There is coastal flood risk at Stornoway, Ardvourlie, Gearraidh Bhaird, Calanais, and Griomarstadh on Lewis, Scalpay, Leverburgh and Fionnsabhaigh on Harris. The main urban area at risk of coastal flooding is Stornoway where there are approximately 20 residential properties at risk of flooding from the sea.

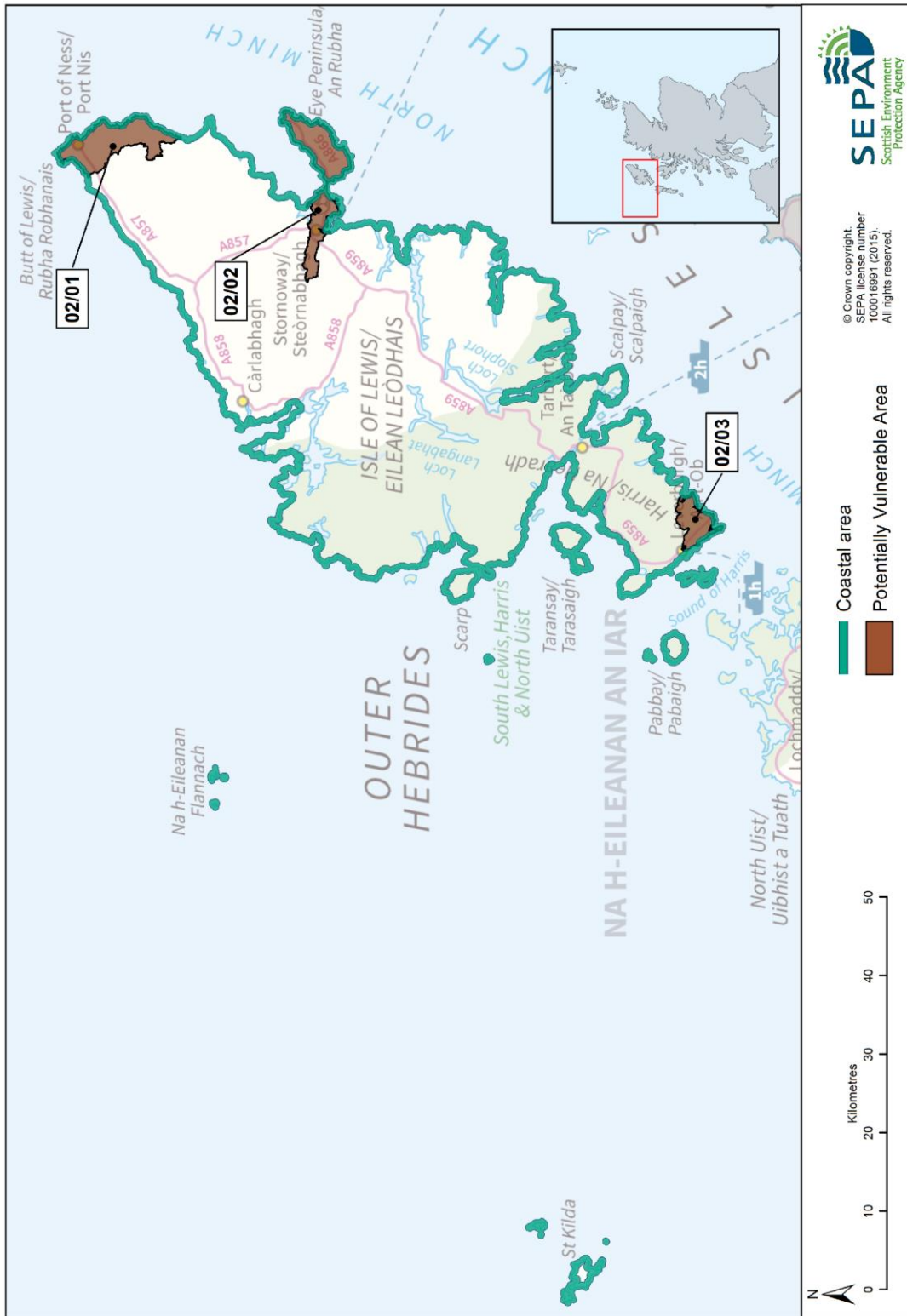


Figure 1: Lewis and Harris coastal area and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the Lewis and Harris coastal area are approximately £600,000. This accounts for around 26% of the total damages for the Local Plan District from flooding. The damages are distributed as follows:

- 41% non-residential properties (£240,000)
- 33% roads (£200,000)
- 16% residential properties (£99,000)
- 6% emergency services (£37,000)
- 2% agriculture (£11,000)
- 1% vehicles (£7,500).

Figure 2 shows the location of Annual Average Damages from coastal flooding across the area. The highest damages are in Stornoway.

There are approximately 110 road locations at risk of coastal flooding. The main routes affected include the A857, A859 and A866. Minor roads are also impacted. Stornoway airport is also at risk of coastal flooding.

Designated environmental and cultural heritage sites at risk

The Outer Hebrides have hundreds of archaeological sites situated along the coast and in the adjacent low lying areas. Many of these sites are in a relatively good condition and have minimal disturbance. The main threat to these sites is from coastal erosion.

In relation to the many cultural heritage sites at risk of coastal erosion, assessment surveys and excavations, such as those run by the SCAPE Trust (Scottish Coastal Archaeology and the Problem of Erosion), and information recorded by other agencies have helped to highlight this issue.

There are 31 designated cultural heritage sites at risk of coastal flooding. These sites include scheduled monuments and listed buildings.

Approximately 7km² of environmentally designated area is at risk of coastal flooding including Special Protection Areas and Sites of Special Scientific Interest. The sites affected include Stornoway Castle Woodlands, Tong Saltings, Lewis Peatlands and Port of Ness.

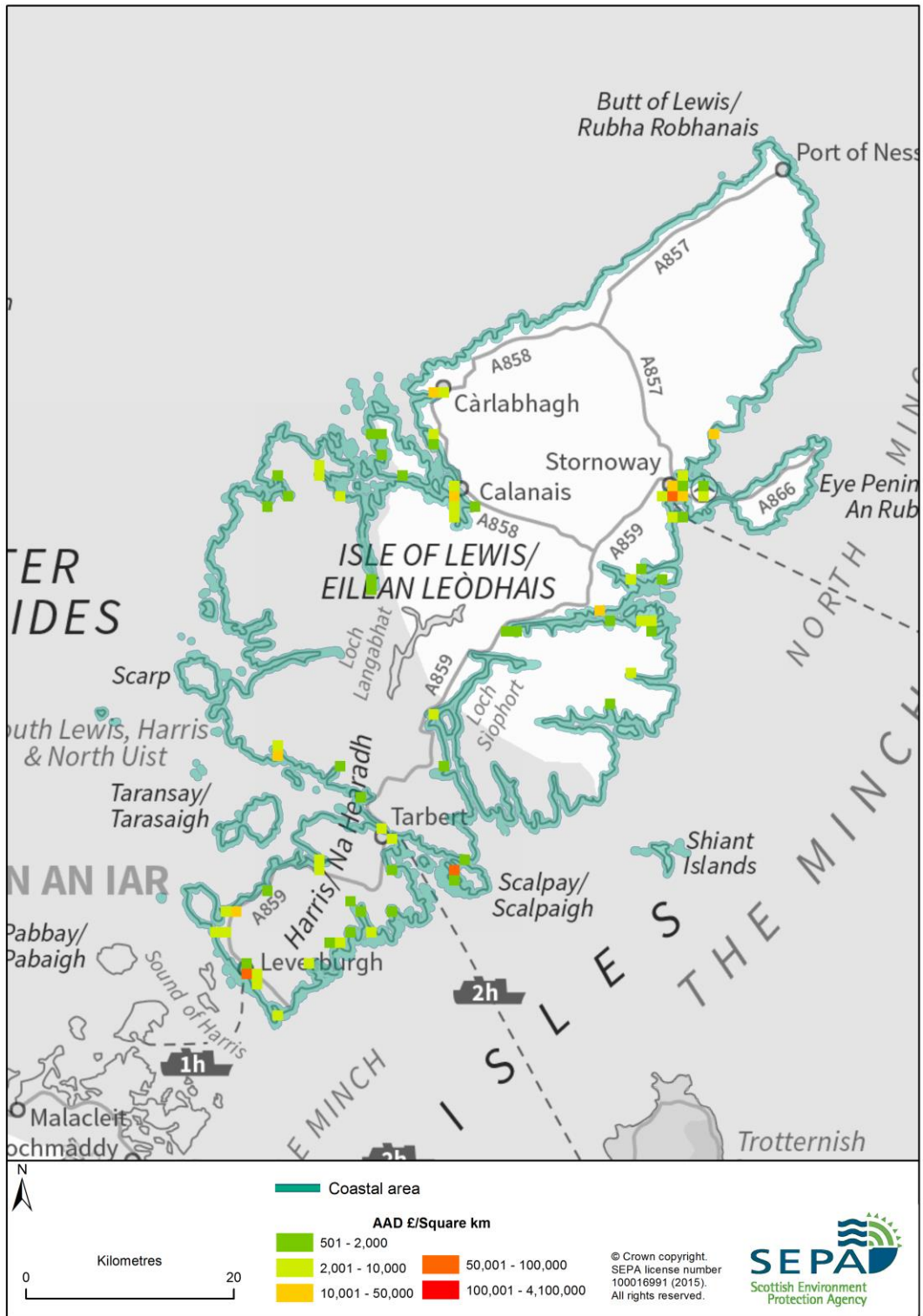


Figure 2: Annual Average Damages from coastal flooding

History of flooding

Stornoway was affected by a coastal flood in February 1990 when the airport, streets and Town Hall were flooded, the bus station was cut off by waves and there was a loss of power. This is the largest coastal flood on record, although there have been a number of localised floods.

A more recent flood occurred in early January 2014, when roads in Stornoway were closed due to flooding caused by a combination of high spring tides and unusually low atmospheric pressure. Fortunately, the surge was not accompanied by wind and wave action, and the flooding was solely due to the high still water. Flood waters did not enter properties on this occasion.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

Existing actions that are in place to manage flood risk in this coastal area are described in Section 2.

Climate change and future flood risk

UK Climate Projections (UKCP09) predicts that climate change may increase sea levels. The magnitude of sea level rise varies around the coastline.

For the UKCP09 high emissions scenario, the predicted average sea level increase for the Lewis and Harris coastal area is 0.55m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 40 to 160, and the number of non-residential properties from 90 to 190. Coastal flood modelling by SEPA has not taken into account the impacts of a future climate on wave overtopping or storminess, which could increase the number of properties affected by coastal flooding.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (<http://www.sepa.org.uk/environment/water/flooding/flood-maps/>). The maps indicate the potential for wave attenuation and estuarine surge attenuation. They show areas where natural flood management could be effective and where further detailed assessment should take place.

This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Estuarine surge

No assessment of estuarine surge attenuation potential was carried out for the Outer Hebrides.

Wave energy

There are a number of relatively short sections of the coastline on Lewis and Harris that have potential for wave energy dissipation. For example, along the western coast of northern Lewis. Further examples can be found along the southern end of Broad Bay and along the strip of land connecting with the Eye Peninsula.

Coastal flooding North Uist and Berneray

Coastal overview

The North Uist and Berneray coastal area (Figure 1) has a coastline with a length of approximately 350km. It comprises the islands of North Uist and Berneray which form the central part of the Outer Hebrides Local Plan District.

The coastline is embayed with inlets and sea lochs particularly on the east and south coast. The east is dominated by a hard rocky coast with intertidal rock platforms and occasional sparse beaches.

On the north and west coasts rock outcrops and headlands control the location and shape of the extensive, wide sandy beaches that are often backed by dunes and machair grasslands. Many of the beaches on the west coast are sheltered by offshore islands, rock reefs and shoals. The beaches are relatively stable with minimal net sediment losses. Transport by wind is probably the most dynamic erosive process occurring at present.

Due to the wide and shallow coastal slope, and the rocky and irregular bathymetry, most of the Atlantic wave energy is dissipated before the waves reach the coastline. Wave action is therefore greatest during spring tides and / or during storm surges when water depths can sustain larger waves.

There are two Potentially Vulnerable Areas:

- Lochmaddy and Trumisgarry (02/04)
- North Uist (02/05)

Flood risk in the coastal area

Within the North Uist and Berneray coastal area, there are approximately 20 residential properties and 10 non-residential properties at risk of coastal flooding. Approximately 20% of residential and 50% of non-residential properties in this coastal area are located within Potentially Vulnerable Areas.

Main areas at risk

There is coastal flood risk to residential properties at Borgh on Berneray, Port nan Long, Malacleit, Cnoc a' Lin, Lochmaddy on North Uist and the island of Grimsay.

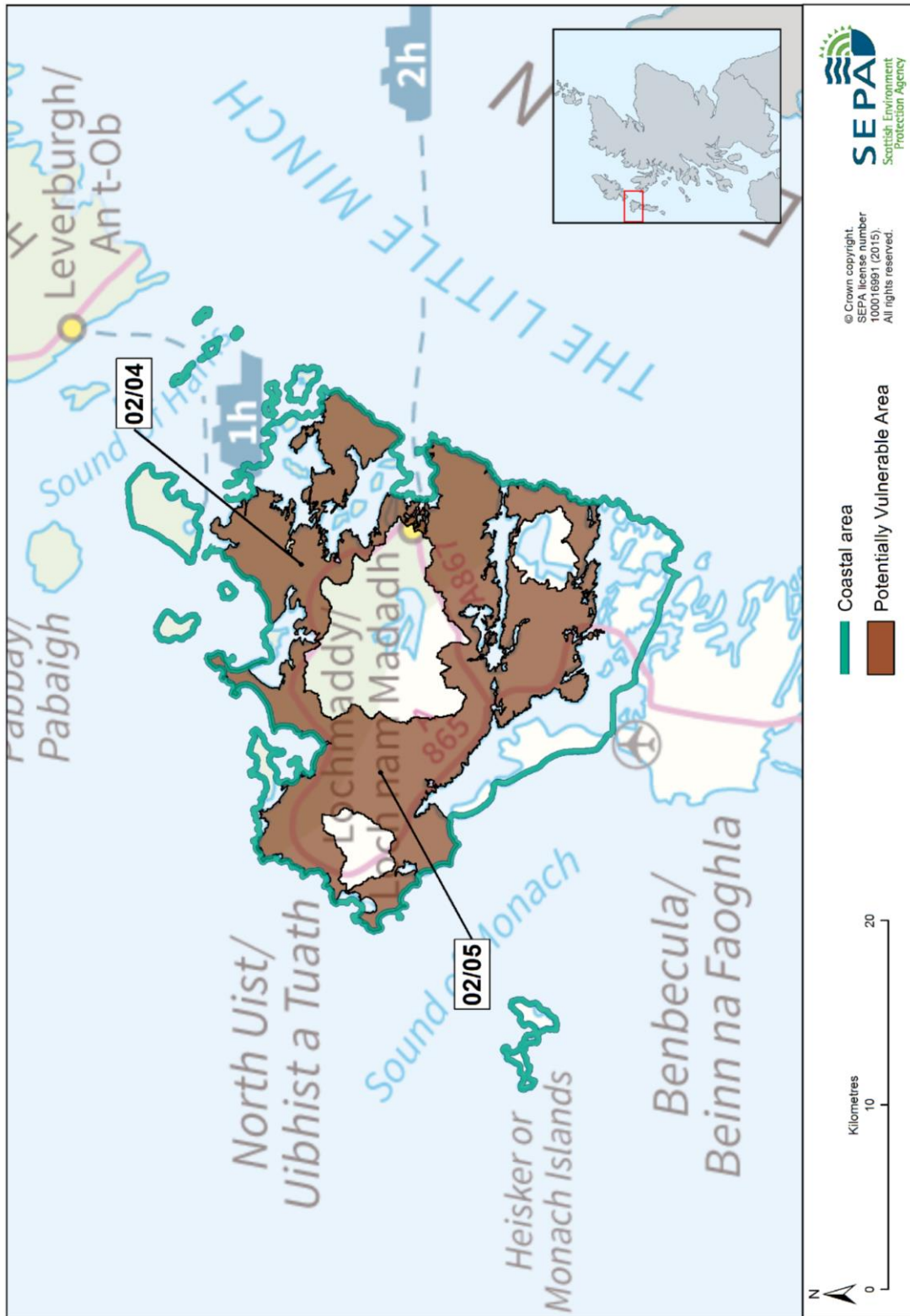


Figure 1: North Uist and Berneray coastal area and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the North Uist and Berneray Coastal area are approximately £260,000. This accounts for around 11% of the total damages for the Local Plan District from all sources of flooding. The damages are distributed as follows:

- 58% roads (£150,000)
- 27% residential properties (£71,000)
- 5% non-residential properties (£12,000)
- 4% emergency services (£10,000)
- 4% agriculture (£9,000)
- 2% vehicles (£6,200)

Figure 2 shows the location of Annual Average Damages from coastal flooding across the area.

There are approximately 60 road locations at risk of coastal flooding. The main routes affected include the A865, A867, B893 and B894. Minor roads are also impacted.

Designated environmental and cultural heritage sites at risk

The Outer Hebrides have hundreds of archaeological sites situated along the coast and in the adjacent low lying areas. Many of these sites are in a relatively good condition and have minimal disturbance. The main threat to these sites is from coastal erosion.

In relation to the many cultural heritage sites at risk of coastal erosion, assessment surveys and excavations such as those run by the SCAPE Trust (Scottish Coastal Archaeology and the Problem of Erosion), and information recorded by other agencies have helped to highlight this issue.

There are 11 cultural heritage sites at risk of coastal flooding, all of which are designated as scheduled monuments. The majority of the sites are prehistoric domestic and defensive sites.

Approximately 30km² of environmentally designated area is at risk of coastal flooding including Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Sites of Special Scientific Interest (SSSI). The sites affected include Loch Nam Madadh, North Uist Machair, Loch an Duin, Machairs Robach and Newton, Obain Loch Euphoirt, Mointeach Scadabhaigh, Loch Obisary, Balranald Bog and Loch nam Feithean.

A study conducted shortly after the January 2005 storm has shown that machair habitats are resilient to short duration seawater flooding, possibly due to the high level of interaction between freshwater/brackish water in the inland machair loch system and the water table (Angus S. & Rennie A.F. 2012). However, if seawater flooding is more persistent, either due to a failure of drainage systems or to more frequent marine inundation, this dispersal effect may become a liability as it would result in saline contamination to both the groundwater and the surface water.

Management of drainage systems is therefore important for flood water dispersal and for maintaining current levels of salinity in the water table. Adjustments may be required to cope with increased saline inflow caused by rising sea level, but as sea level rises still further it will become more difficult for the drainage system to cope.

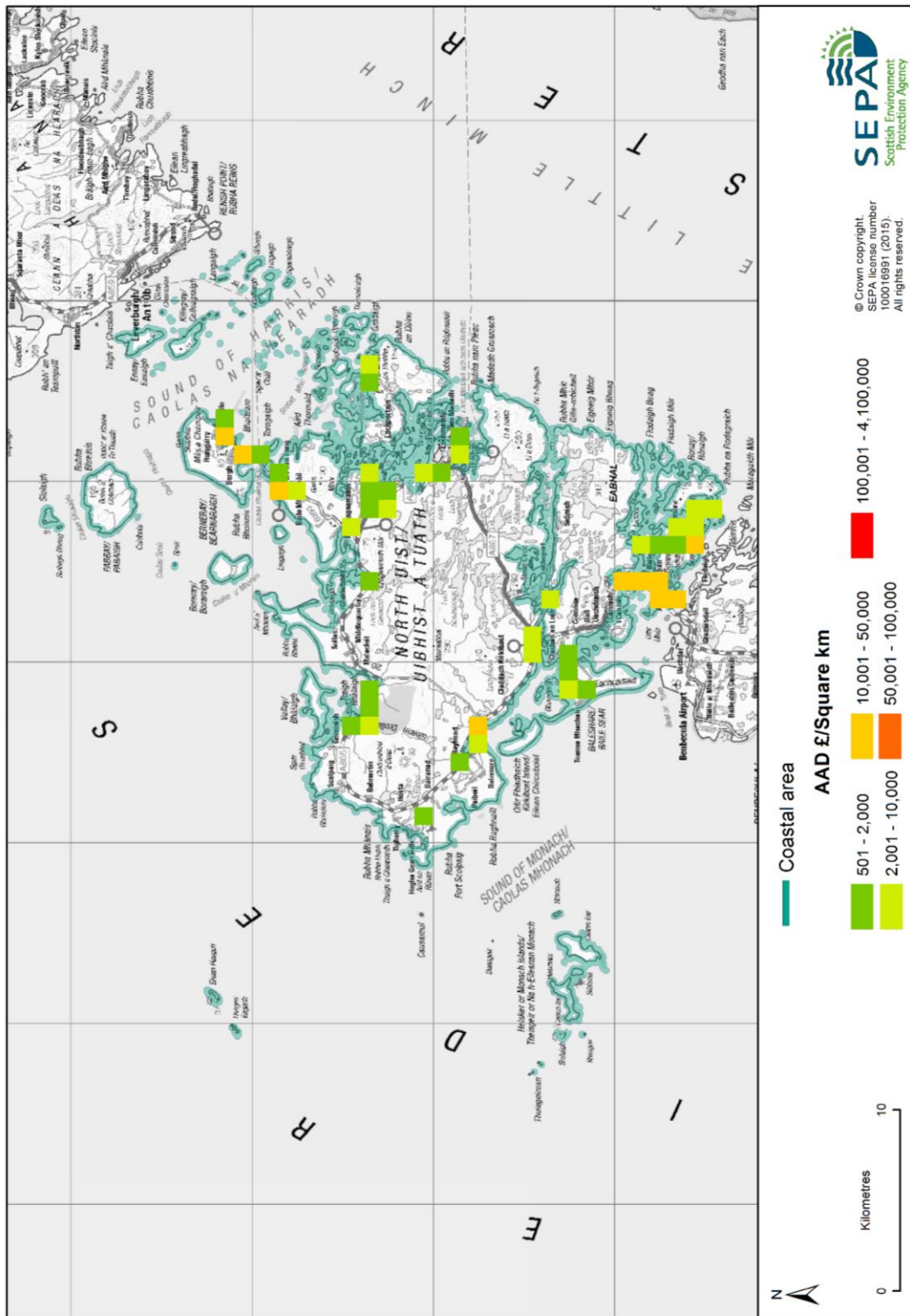


Figure 2: Annual Average Damages from coastal flooding

History of flooding

In January 2005 a severe storm hit the west coast of Scotland including the Outer Hebrides. Sections of the causeway that joins North Uist to the neighbouring islands of Grimsay and Benbecula were virtually destroyed. Causeways at Baleshare and at Ard Heisgeir suffered severe damage, and significant coastal flooding occurred in many locations including the main road junction at Clachan. The Baleshare causeway is overtopped on a regular basis and rocks, stones and seaweed are washed onto the carriageway.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

Existing actions that are in place to manage flood risk and that are in addition to the information presented in Section 2 are described below.

Awareness raising campaigns and community groups

The European funded CoastAdapt project (www.coastadapt.org) investigated means of adaptation to a changing climate with Comhairle nan Eilean Siar as lead partner. Coastal erosion and flooding have been discussed by the North Uist Community Council on a number of occasions.

Climate change and future flood risk

UK Climate Projections (UKCP09) predicts that climate change may increase sea levels. The magnitude of sea level rise varies around the coastline.

For the UKCP09 high emissions scenario, the predicted average sea level increase for the North Uist to Berneray coastal area is 0.53m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 20 to 30 and the number of non-residential from approximately 10 to 20. Coastal flood modelling by SEPA has not taken into account the impacts of a future climate on wave overtopping or storminess, which could increase the number of properties affected by coastal flooding.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (<http://www.sepa.org.uk/environment/water/flooding/flood-maps/>). The maps indicate the potential for wave attenuation and estuarine surge attenuation. They show areas where natural flood management could be effective and where further detailed assessment should take place.

This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Estuarine surge

No assessment of estuarine surge attenuation potential was carried out for the Outer Hebrides.

Wave energy

Beach systems in the Outer Hebrides, whether sand, shingle or dunes provide a natural coastal defence function thereby reducing the risk of flooding. A notable feature of the inshore seabed to the west of the islands is its shallow gradient, which together with vast kelp forests play a critical role in protecting the soft coastline of the Uists from wave action. The combination of shallow gradient and roughness created by the kelp forest greatly dissipate wave energy.

The northern and western coastlines of North Uist and Berneray have potential for wave energy dissipation. The main area with potential for wave energy dissipation is on the northern coastline around the Beinn Mhor peninsula, particularly along the machair on the western coastline. There are significant lengths of potential for wave energy dissipation around the Aird a Mhorain peninsula, Traigh Bhalairigh bay and the entire west coast from Aird an Runair to Carinish including Kirkibost Island and Baleshare. There is little potential along the eastern and southern coastline.

Coastal flooding Benbecula, South Uist and Barra

Coastal overview

The Benbecula, South Uist and Barra coastal area (Figure 1) has a coastline with an approximate length of 830km. It comprises the southern portion of the Outer Hebrides Local Plan District and includes the islands of Benbecula, South Uist and Barra.

The predominant landform on the west coast is machair grasslands, often flanked with sand dunes which can extend up to two kilometres inland from the coastline. By contrast the east coast is dominated by a hard rocky coast which is typically embayed with inlets, sea lochs and only sparse beaches.

There are also a large number of shingle beaches on the west coast, in some cases forming ridges lying above sandy beaches or forming the core of the sandy beaches. However, due to a sediment deficit much of the coastline is eroding and over 30% of beaches lack a protective dune cordon. In these areas the coast is susceptible to over wash and flooding. Coastal flooding is also a major risk to the delicately balanced machair ecosystem. Large areas of the machair are near mean sea-level in elevation making natural drainage of these areas increasingly challenging.

Due to the wide and shallow coastal slope, and the rocky and irregular bathymetry, most of the Atlantic wave energy is dissipated before the waves reach the coastline. Wave action is therefore greatest during spring tides and / or during storm surges when water depths can sustain larger waves.

There are three Potentially Vulnerable Areas:

- Benbecula (02/06)
- Lochs Bi and Druidibeag (02/07)
- Bornish to Boisdale (02/08).

Flood risk in the coastal area

Within the Benbecula, South Uist and Barra coastal area, there are approximately 120 residential properties and 30 non-residential properties at risk of coastal flooding. Approximately 94% of residential and 71% of non-residential properties at risk are located within the three Potentially Vulnerable Areas.

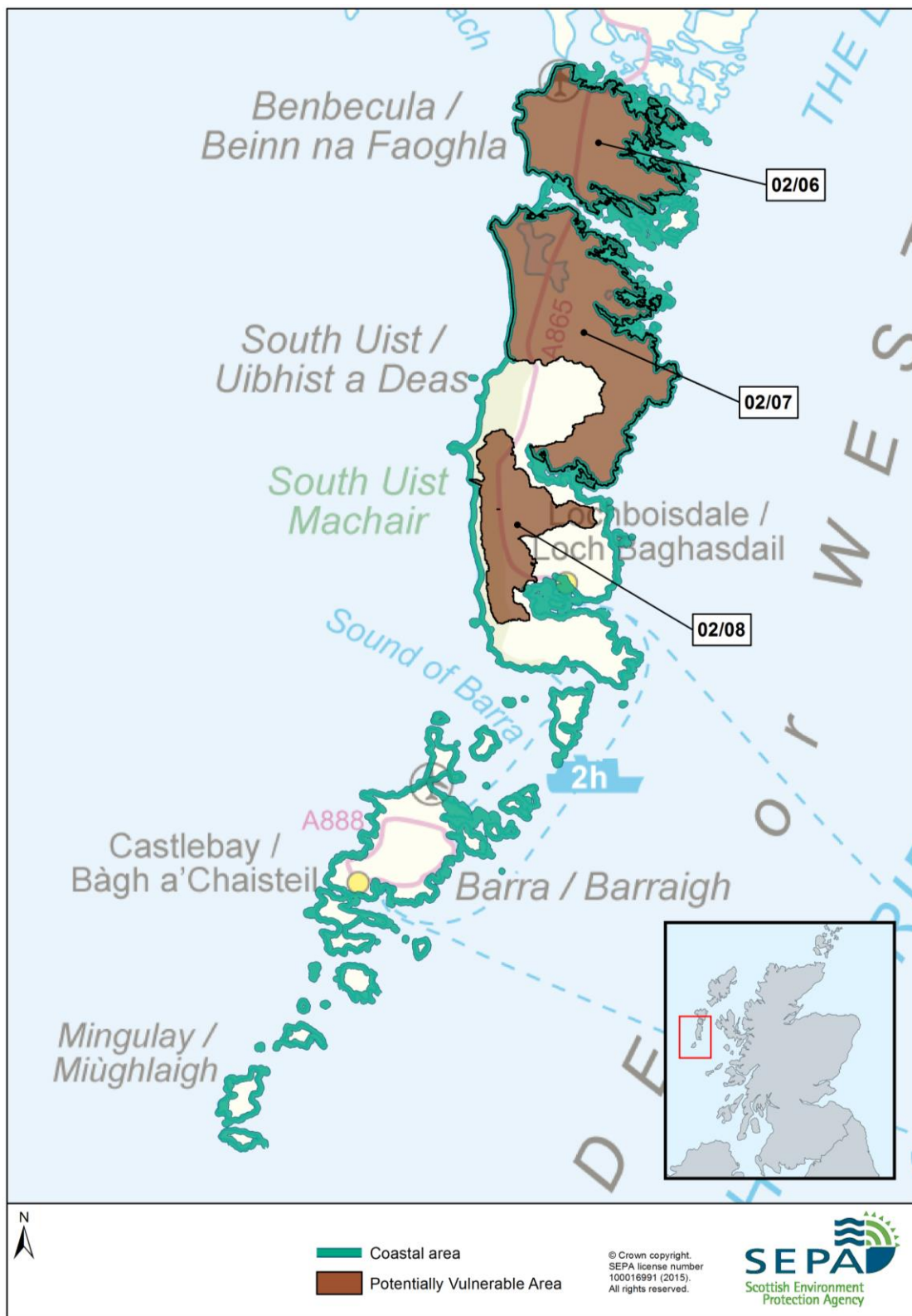


Figure 1: Benbecula, South Uist and Barra coastal area and Potentially Vulnerable Areas

Main areas at risk

The location with the largest number of properties at risk of coastal flooding is Balivanich. There is also coastal flood risk in the Dalabrog and lochdar areas on South Uist and Gramasdail, Creagorry and Lionacleit on Benbecula.

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the Benbecula, South Uist and Barra coastal area are estimated to be approximately £930,000. This accounts for around 40% of the total damages for the Local Plan District from all flood sources. The damages are distributed as follows:

- 40% residential properties (£370,000)
- 35% roads (£330,000)
- 12% non-residential properties (£110,000)
- 6% emergency services (£52,000)
- 4% vehicles (£36,000)
- 3% agriculture (£28,000).

Figure 2 shows the location of Annual Average Damages from coastal flooding across the area.

There are approximately 150 road locations at risk of coastal flooding. The main routes affected include the A865, B891 and B892. Minor roads are also impacted. The airport at Benbecula is at risk of coastal flooding.

Designated environmental and cultural heritage sites at risk

The Outer Hebrides have hundreds of archaeological sites situated along the coast and in the adjacent low lying areas. Many of these are in a relatively good condition and have minimal disturbance. The main threat to these sites is from coastal erosion.

In relation to the many cultural heritage sites at risk of coastal erosion, assessment surveys and excavations such as those run by the SCAPE Trust (Scottish Coastal Archaeology and the Problem of Erosion), and information recorded by other agencies have helped to highlight this issue.

There are 15 cultural heritage sites at risk of coastal flooding. Most of these are scheduled monuments and the majority are prehistoric domestic and defensive sites. There is one listed building at risk of coastal flooding.

Approximately 30km² of environmentally designated area is at risk of coastal flooding including Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Sites of Special Scientific Interest (SSSI). The sites affected include South Uist Machair, Bornish and Ormiclate Machairs, Loch Hallan, Aird and Borge Benbecula, West Benbecula Lochs, Howmore Estuary, Lochs Roag and Fada, Loch Druidibeg, Loch Bee, and Kilpheder to Smerclate South Uist.

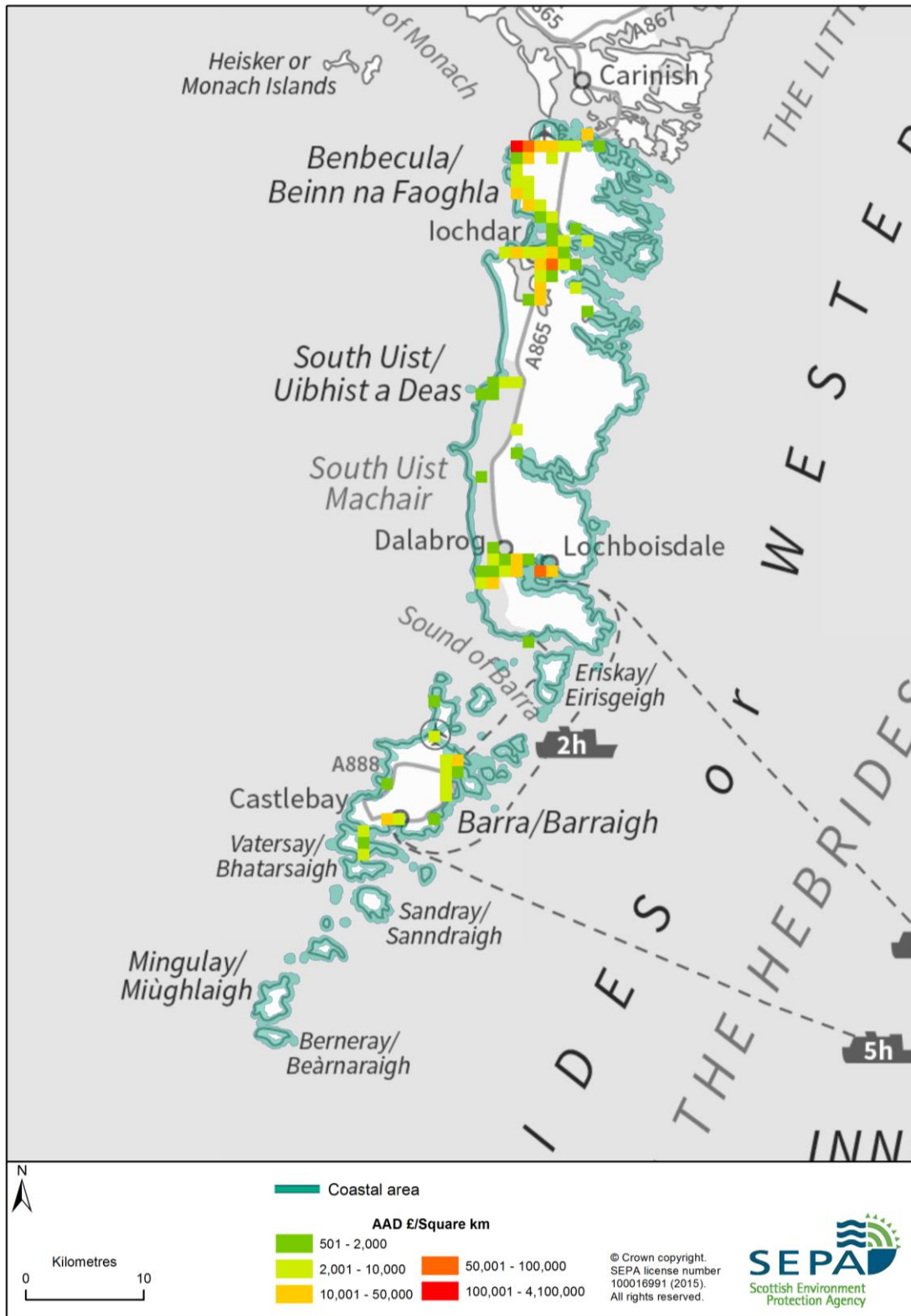


Figure 2: Annual Average Damages from coastal flooding

A study conducted shortly after the January 2005 storm has shown that machair habitats are resilient to short duration seawater flooding possibly due to the high level of interaction between freshwater/brackish water in the inland machair loch system and the water table (Angus S. & Rennie A.F. 2012). However, if seawater flooding is more persistent, either due to a failure of drainage systems or to more frequent marine inundation, this dispersal effect may become a liability as it would result in saline contamination to both the groundwater and the surface water.

Management of drainage systems is therefore important for flood water dispersal and for maintaining current levels of salinity in the water table. Ingress of saltwater into freshwater systems such as Loch Bi can be detrimental to salmonid populations. Adjustments to operation of gates and flap valves may be required to cope with increased saline inflow caused by rising sea level, but as sea level rises still further, it will become more difficult for the drainage system to cope.

History of flooding

In January 2005 a severe storm hit the west coast of Scotland including the Outer Hebrides. During the storm five people from the same family died when their cars were swept from a coastal road in lochdar, South Uist as they were trying to escape from flood waters. Widespread flooding occurred in many locations, particularly on the west coast, with roads, agricultural land, houses and other buildings being inundated with sea water. More recently, on 1 February 2014, there was flooding on the B892 at Stinky Bay in Benbecula.

Coastal flooding has occurred on a number of occasions on the islands when storm surge and high tides coincide.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

Existing actions that are in place to manage flood risk and that are in addition to the information presented in Section 2 are described below.

Awareness raising campaigns and community groups

There are two community flood action groups, the lochdar Flood Action Group and the Middle District Flood Action Group which were formed in the immediate aftermath of the January 2005 storm. Public meetings and workshops have been held in recent years to discuss flooding and coastal erosion issues particularly in Benbecula and South Uist. These events have been well attended reflecting the importance of coastal issues to the local population and the willingness of local people to be involved in decision making and implementation of schemes.

Organisations that have been involved include the Comhairle nan Eilean Siar; Scottish Natural Heritage; Coast Hebrides, the local coastal partnership (www.coasthebrides.co.uk); Stòras Uibhist, the community land owner; the CoastAdapt project (www.coastadapt.org); and Oxfam Scotland who provided community education and support.

Comhairle nan Eilean Siar was the lead partner in the CoastAdapt EU project which aimed to safeguard people living in North Atlantic coastal communities and help them adapt to the impacts of climate change.

Climate change and future flood risk

UK Climate Projections (UKCP09) predicts that climate change may increase sea levels. The magnitude of sea level rise varies around the coastline.

For the UKCP09 high emissions scenario, the predicted average sea level increase for the Benbecula, South Uist and Barra coastal area is 0.52m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 120 to 210, and the number of non-residential properties will increase from 30 to 60. Coastal flood modelling by SEPA has not taken into account the impacts of a future climate on wave overtopping or storminess, which could increase the number of properties affected by coastal flooding.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (<http://www.sepa.org.uk/environment/water/flooding/flood-maps/>). The maps indicate the potential for wave attenuation and estuarine surge attenuation. They show areas where natural flood management could be effective and where further detailed assessment should take place.

This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Estuarine surge

No assessment of estuarine surge attenuation potential was carried out for the Outer Hebrides.

Wave energy

Beach systems in the Outer Hebrides, (whether sand beaches, shingle beaches or dunes), provide a natural coastal defence function that reduces the risk of flooding. A notable feature of the inshore seabed to the west of the islands is its shallow gradient, which together with vast kelp forests which grow on it, play a critical role in protecting the soft coastline of the Uists from wave action. The combination of shallow gradient and roughness created by the kelp forest greatly dissipate wave energy.

The main areas of potential for wave energy attenuation tend to be on the soft sandy western coastlines of the Benbecula, South Uist and Barra coastal area. Very little potential has been identified along the eastern coastlines.

Due to a sediment deficit much of the western coastline is eroding and a large proportion lacks a protective dune cordon. In these areas the coast is susceptible to over wash and flooding which is of particular concern as the level of the land generally decreases inland from the coastal edge. Potential exists for rebuilding gaps in dune systems and for development of methods to counter undercutting of the low machair edge by wave action.

On Benbecula the entire western coastline from the airport to Luib Bhan bay has potential for wave energy dissipation. There are also small areas of potential at Rubha ma-thuath on the south coast, Rairnis and Orasaigh Uisgeabhigh on the east coast, and the area around the end of the causeway from Grimsay. On South Uist the entire western coastline has potential for wave energy dissipation.

The South Ford Hydrodynamics Study has identified beach recharge at Gualan Island together with dune stabilisation at Lionacleit as a means of wave energy dissipation for the South Ford area and the south west coast of Benbecula.

3.4 Surface water flooding

Outer Hebrides Local Plan District

This chapter provides supplementary information on surface water flooding across the Local Plan District. It provides an overview of the main areas at risk and a history of surface water flooding. The predicted impacts on infrastructure are also identified. Due to the nature of surface water flooding, the impacts on environmental sites and agricultural land have not been assessed.

Information about the objectives and actions to manage flood risk are provided in the relevant Potentially Vulnerable Area chapters in Section 2.

Flood risk

Within the Outer Hebrides Local Plan District there are estimated to be fewer than 10 residential properties at risk of surface water flooding. The number of non-residential properties at risk of surface water flooding is approximately 30, representing a small proportion of the total number at risk of flooding from all sources.

Economic activity and infrastructure at risk

The Annual Average Damages from surface water flooding are estimated to be £59,000. This accounts for just 3% of the total flood damages for the Local Plan District. The damages are distributed as follows:

- 89% non-residential properties (£52,000)
- 11% residential properties (£6,700)

Figures 1a and 1b shows the location of Annual Average Damages from surface water flooding across the Local Plan District.

Approximately 340 road locations and small sections of the airport runways at Stornoway and Benbecula are also at risk of surface water flooding.

Designated environmental and cultural heritage sites at risk

There are an estimated 50 designated cultural heritage sites at risk of surface water flooding in the Outer Hebrides. These sites include scheduled monuments and designed gardens and landscapes.

The impact of surface water flooding on environmental sites has not been assessed and is assumed to be relatively low.

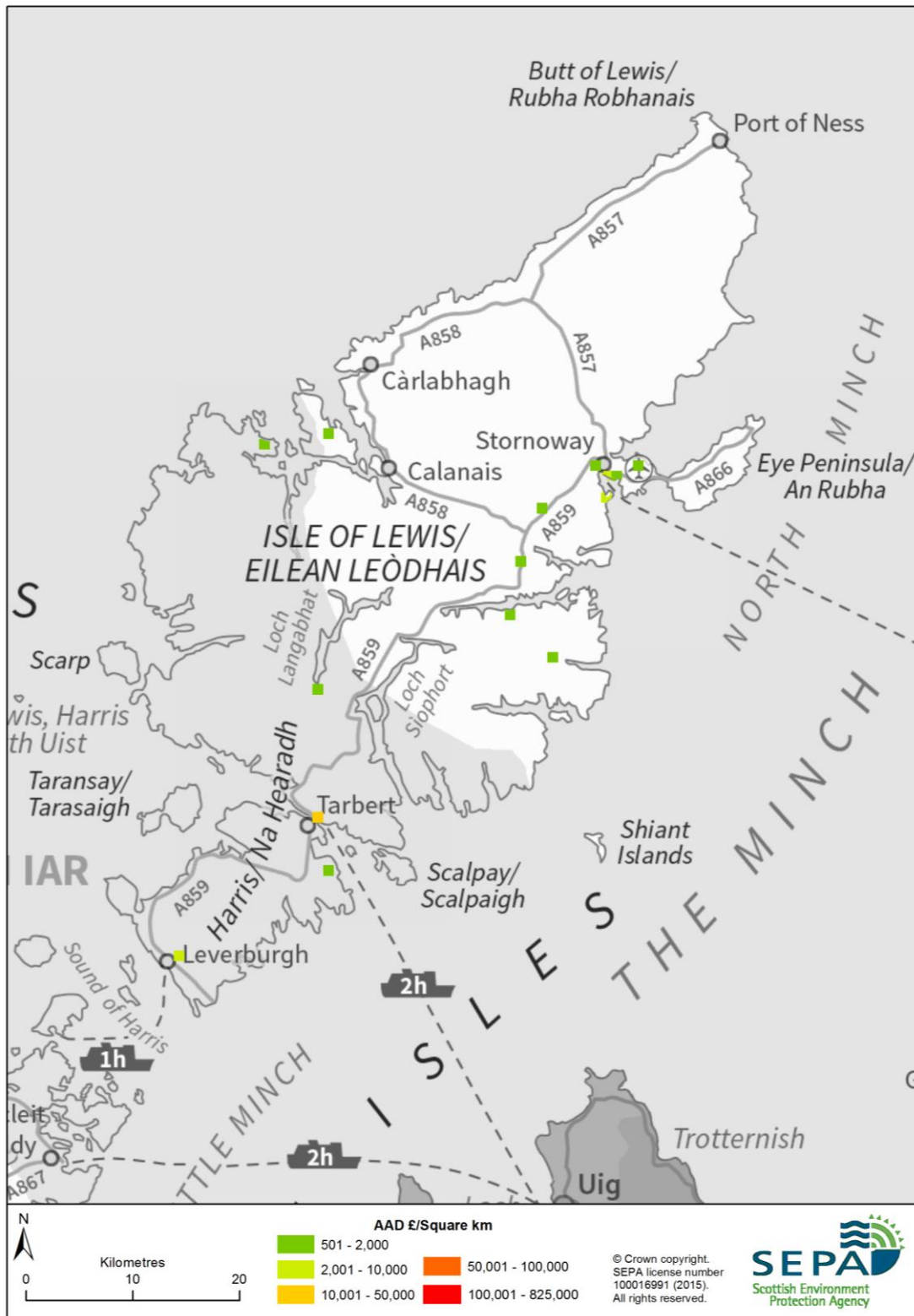


Figure 1a: Annual Average Damages from surface water flooding on Lewis and Harris

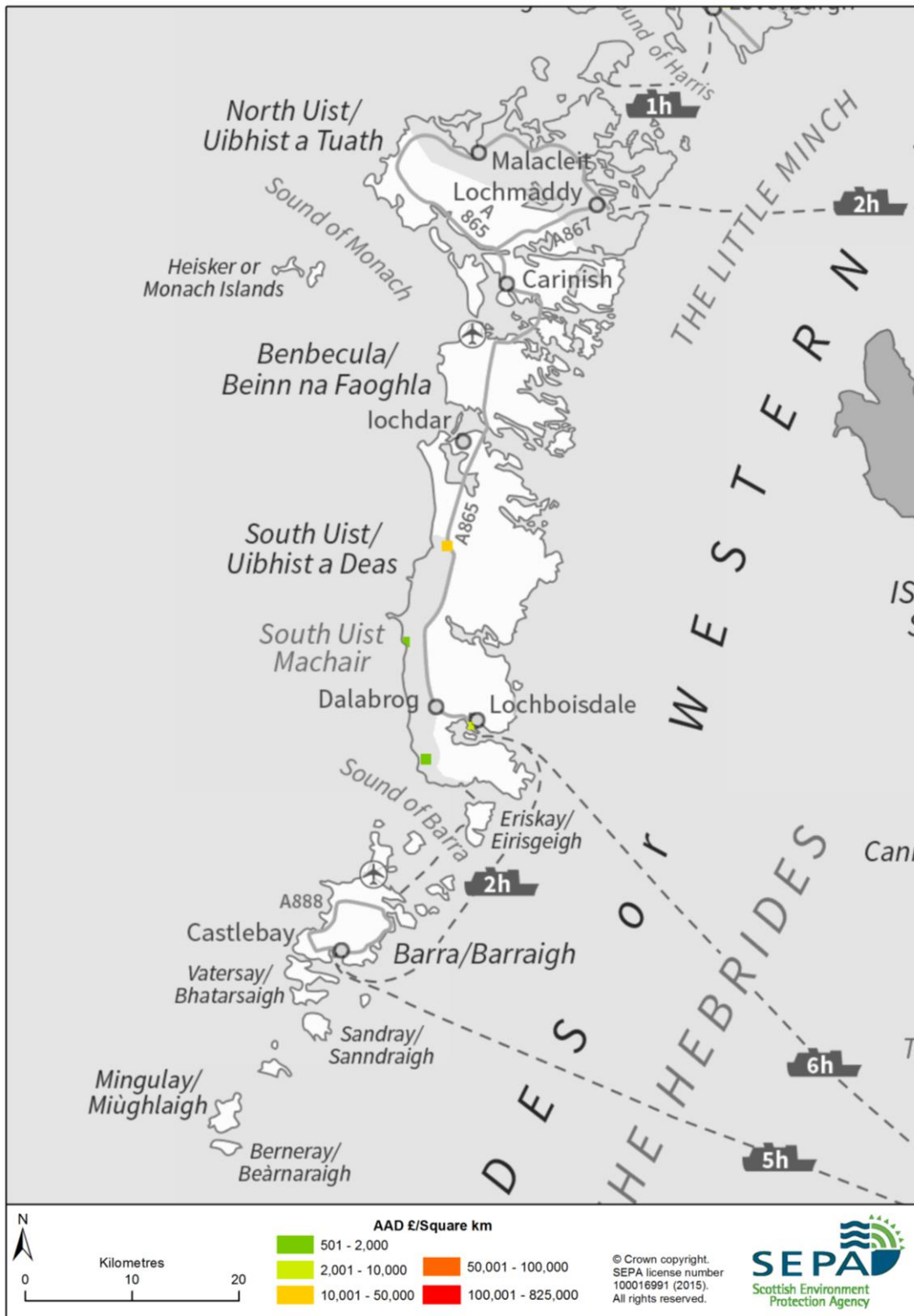


Figure 1b: Annual Average Damages from surface water flooding on Berneray, North Uist, Benbecula, South Uist and Barra

History of surface water flooding

There have been a number of localised floods due to surface water. These floods often occur during periods of tidal surge combined with high rainfall and can result in flooding of land upstream of river estuaries, such as at the Howmore River (Tabha Mor) in South Uist and low-lying parts of Stornoway.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

Surface water flooding, taken on its own, has a relatively low impact on overall flood risk in the Outer Hebrides. However, when combined with high tide levels, or when surface water discharge to sea outfalls is reduced or blocked, localised flooding can occur as a consequence. Management of surface water flooding is therefore closely linked to river and coastal flood management and this interaction will be taken into account as far as practical in the consideration of river and coastal flood issues.

Surface water management priority areas

The areas at highest risk from surface water flooding nationally have been identified as priority areas. These priority areas were identified using SEPA flood models, supplemented with evidence from historic surface water floods and, where available, more detailed modelling carried out by local authorities.

Due to the relatively low impact of surface water flooding assessed for the Outer Hebrides, no specific surface water priority areas have been identified for detailed study. However any instances of surface water flooding will be investigated by the local authority and Scottish Water as appropriate.

Climate change and future flood risk

UK Climate Projections (UKCP09) predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall. The surface water modelling undertaken considered climate change scenarios with a 20% increase in rainfall intensity.

Under these conditions it is estimated that the number of residential properties at risk of surface water flooding does not change significantly. However this does not take account of the combined impact of sea level rise and a consequential rise in groundwater and loch levels.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.