

Flood Risk Management Strategy

Highland and Argyll 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 Highland and Argyll Local Plan District, river flooding is reported across seven distinct river catchments. Coastal flooding is reported over six distinct coastal areas and surface water flooding is 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			
Wick, Thurso and Naver catchment group	160	£1.0 million	The Highland Council
Helmsdale, Shin and Conon catchment group	440	£1.5 million	The Highland Council
Ness and Beaully catchment group	1,100	£2.9 million	The Highland Council
Fyne, Firth of Clyde, Awe and Etive, and Kintyre catchment group	1,300	£3.8 million	Argyll and Bute Council The Highland Council
Loch Linnhe, Lochy (Invernessshire), and Loch Sheil catchment group	270	£920,000	Argyll and Bute Council The Highland Council
Loch Alsh, Loch Maree and Laxford catchment group	240	£1.0 million	The Highland Council
Inner Hebrides catchment group	190	£630,000	Argyll and Bute Council The Highland Council
Coastal flooding			
Nairn to Tarbat Ness coastal area	890	£3.6 million	The Highland Council
Tarbat Ness to Duncansby Head coastal area	40	£230,000	The Highland Council
Duncansby Head to Cape Wrath coastal area	10	£62,000	The Highland Council
Cape Wrath to Ardnamurchan Point coastal area	320	£2.3 million	The Highland Council
Ardnamurchan Point to Mull of Kintyre coastal area	780	£4.4 million	Argyll and Bute Council The Highland Council
Mull of Kintyre to Kilbride Bay coastal area	510	£900,000	Argyll and Bute Council
Surface water flooding			
Highland and Argyll Local Plan District	2,100	£2.9 million	Argyll and Bute Council The Highland Council

Table 1: Summary of flood risk from various sources within the Highland and Argyll Local Plan District

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

3.2 River flooding

Highland and Argyll 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.

In the Highland and Argyll Local Plan District, river flooding is reported across seven river catchment groups (Figure 1).

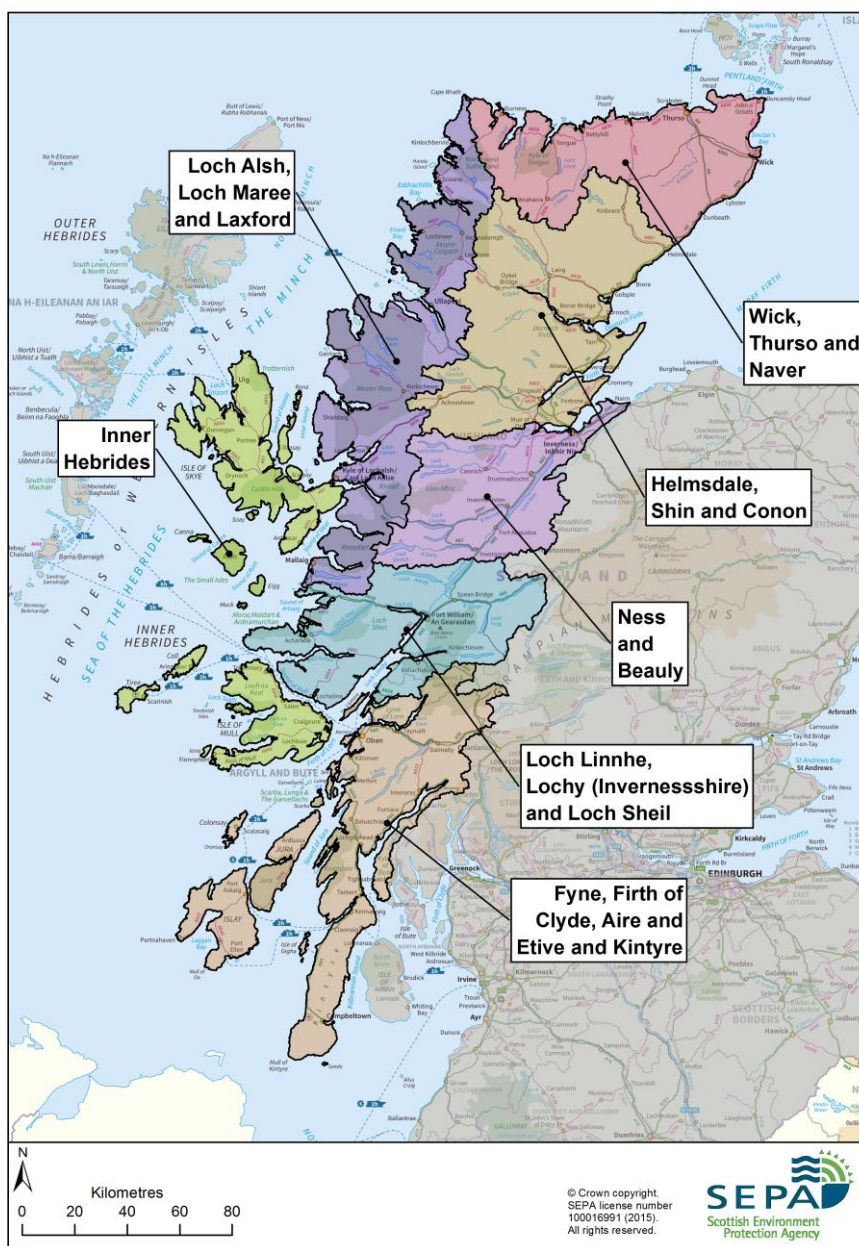


Figure 1: River catchments within the Highland and Argyll Local Plan District

River flooding Wick, Thurso and Naver catchment group

Catchment overview

The Wick, Thurso and Naver catchment group covers the north of the Highland and Argyll Local Plan District (Figure 1) and has an area of approximately 3,800km². There are three main rivers; the River Wick is located in the east of the catchment group, the River Thurso in the north-east, whilst the River Naver drains the highland areas in the north. There are a number of smaller rivers and burns which drain the highland areas into lochs or to the coast. Their catchments are generally small and flashy in nature.

The predominant land cover in the catchment is bog, covering around 36% of the area. Rough grassland (16%) and heather grassland (13%) also provide significant land cover. The east of the catchment group has an annual rainfall of between 800mm and 1700mm with higher rainfall (1700mm to 2800mm per annum) in the west.

There are four Potentially Vulnerable Areas, which are located in the north-east of the catchment group around Thurso and Wick:

- Thurso (01/01)
- Wick Airport (01/02)
- Wick – Burn of Newton (01/03)
- Wick Coastal (01/04).

Flood risk in the catchment

There are approximately 130 residential properties and approximately 30 non-residential properties at risk of river flooding. 55% of residential properties and 16% of non-residential properties at risk are located within Potentially Vulnerable Areas.

Main areas at risk

Almost half of the residential properties at risk of river flooding are located in Wick. There are no other notable concentrations of properties at flood risk, although historical records suggest the risk in Thurso from the River Thurso is likely to be underestimated.

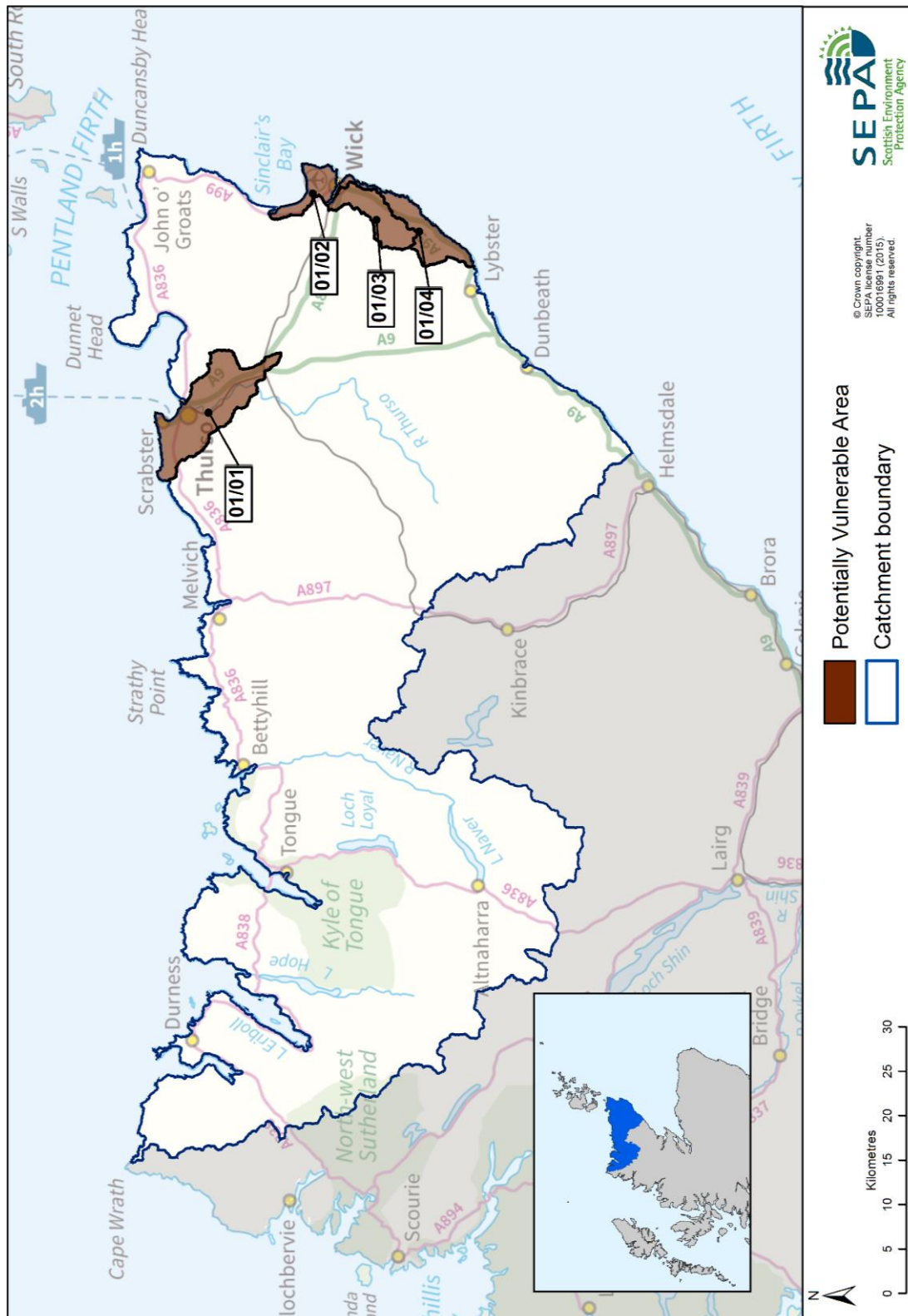


Figure 1: Wick, Thurso and Naver river catchment group and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding in this catchment group area are estimated to be £1.0 million. This accounts for around 4% of the Annual Average Damages for the Highland and Argyll Local Plan District. The damages are distributed as follows:

- 52% residential properties (£560,000)
- 21% non-residential properties (£230,000)
- 14% agriculture (£150,000)
- 9% roads (£96,000)
- 2% emergency services (£26,000)
- 1% vehicles (£10,000).

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

Table 1 shows the approximate numbers of further infrastructure assets which are at risk of flooding within this catchment.

	Number at risk	Further detail
Community facilities	0	n/a
Utility assets	<10	Includes; electricity substations, fuel extraction sites and telephone exchanges
Roads (excluding minor roads)	250 locations	Notably the A99 and A83
Railway routes	30 locations	Inverness to Wick, Inverness to Thurso
Agricultural land (km²)	21	n/a

Table 1: Infrastructure and agricultural land at risk of river flooding

Designated environmental and cultural heritage sites at risk

There are approximately 70 designated cultural heritage sites at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes and listed buildings.

Approximately 176km² of environmental designated area is at risk of river flooding, including Special Areas of Conservation, Special Protection Areas and Sites of Special Scientific Interest. The sites include lochs, peatlands, marshes, and rivers. The designated sites which have the largest areas flooded include Caithness Lochs, Caithness and Sutherland Peatlands, Foinaven, Loch Watten, River Naver, and Loch Calder.

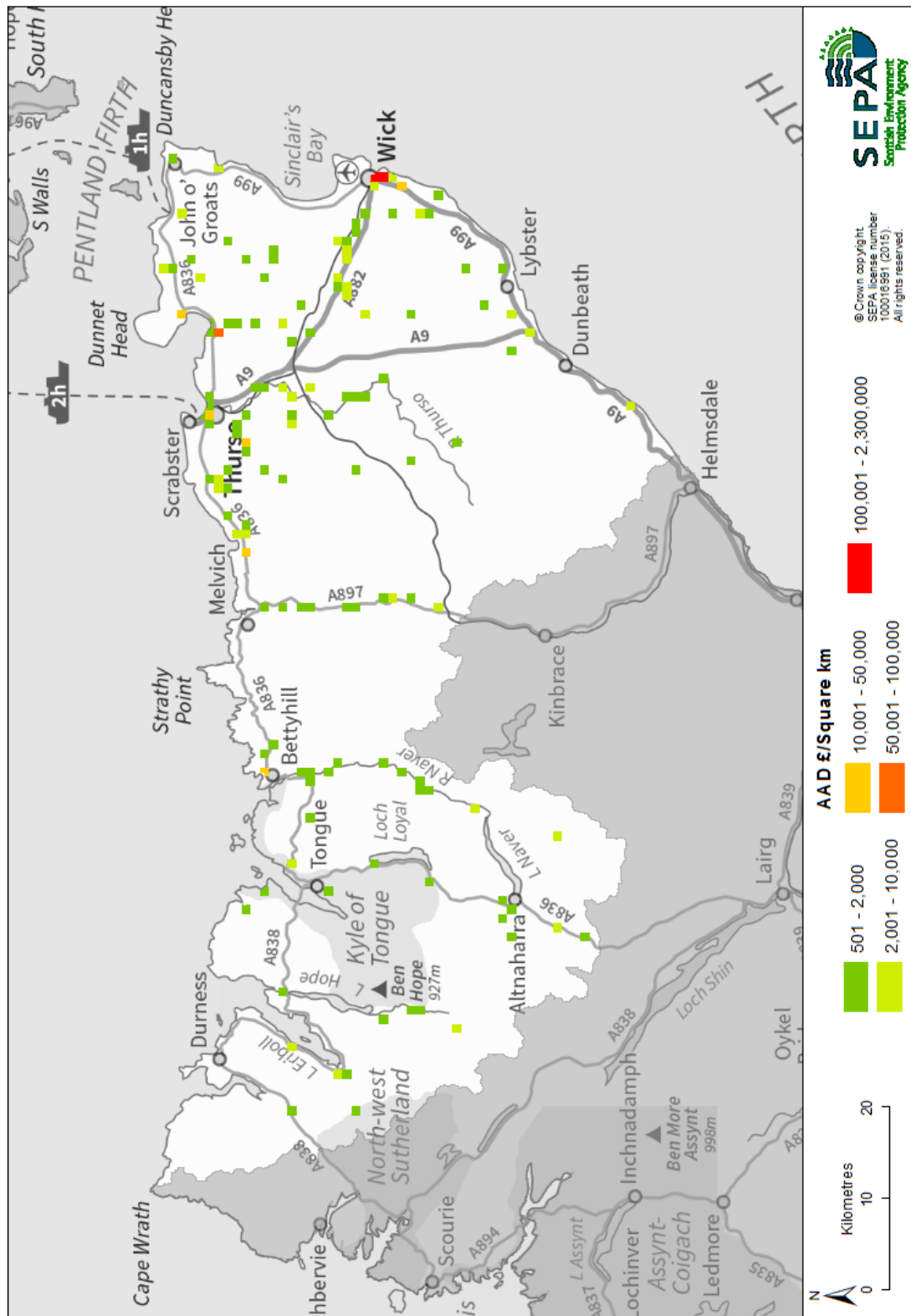


Figure 2: Annual Average Damages from river flooding

History of river flooding

There was a flood in 1903, when several houses flooded in Wick and a railway line was washed away. In 2006, there was flooding of a power station, properties, and roads in Thurso.

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 area are described in Section 2.

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 Wick, Thurso and Naver catchment group may increase by 37%¹. This would potentially increase in the number of residential properties at risk of river flooding from approximately 130 to 140 and the number of non-residential properties from 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 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.

Runoff reduction

There are widespread areas of potential for runoff reduction within the Wick, Thurso and Naver catchment group. However, the areas of potential for runoff reduction are

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

concentrated in the west and south of the catchment and there is limited potential for runoff reduction either within Potentially Vulnerable Areas or in the areas immediately adjacent to Potentially Vulnerable Areas. It is therefore unlikely that runoff reduction measures would have any significant impact on flood risk within the Potentially Vulnerable Areas.

Floodplain storage

There are scattered areas of potential for flood storage throughout the Wick, Thurso, and Naver catchment group, including within all four Potentially Vulnerable Areas. Due to the proximity of some of these areas it is possible that floodplain storage adjacent to or within Potentially Vulnerable Areas may have a beneficial impact on flood risk within the Potentially Vulnerable Areas.

Sediment management

The majority of the system upstream of, and through Thurso is either in balance or moderately eroding, suggesting there is limited potential for improving flood risk through sediment management. The watercourse system which flows through the Loch of Yarrows and Loch Hempriggs in the Wick area is generally in balance or moderately eroding, with areas of deposition in the lochs and short sections of high erosion immediately downstream of the lochs. It is unlikely that there will be significant flood risk improvements through sediment management measures in this catchment.

River flooding Helmsdale, Shin and Conon catchment group

Catchment overview

The Helmsdale, Shin and Conon catchment group covers an area of approximately 5,500km² in the central eastern part of the Highland and Argyll Local Plan District (Figure 1). The largest rivers are the River Shin, River Carron and River Oykel, which discharge into the Dornoch Firth, and the River Conon which discharges into the Cromarty Firth. These rivers drain the highland areas in the west of the catchment group. In addition, there are several smaller rivers which drain the highland areas to the coast include the River Helmsdale, River Brora and River Fleet. The majority of watercourses are relatively small with small catchments that are flashy in nature.

The predominant land covers are acid grassland, bog, coniferous woodland, heather grassland and heather, which each share between 11-18% coverage of the catchment. Rainfall on the higher ground in the west of the catchment group area is typically over 1700mm per annum, whilst the coastal areas and peninsulas receive less rainfall at between 600mm and 1200mm per annum.

There are eight Potentially Vulnerable Areas which are located at the downstream end of the rivers, close to the coast:

- 01/06: Golspie
- 01/07: Dornoch
- 01/08: Tarbat Ness
- 01/09: Invergordon
- 01/10: Alness
- 01/14: Dingwall and Strathpeffer
- 01/15: Contin and Garve
- 01/16: Conon Bridge and Muir of Ord.

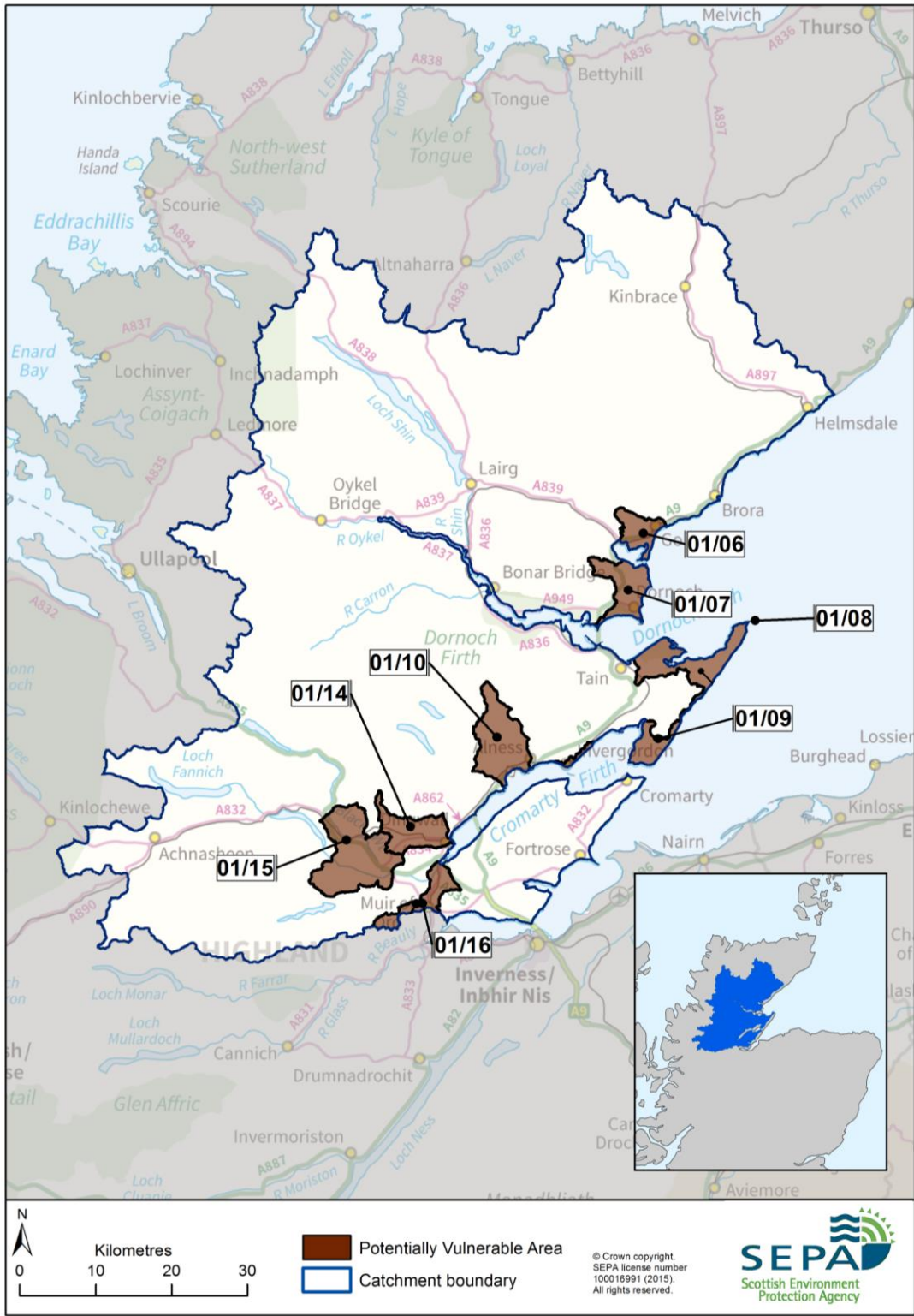


Figure 1: Helmsdale, Shin and Conon river catchment group and Potentially Vulnerable Areas

Flood risk in the catchment

There are approximately 290 residential properties and approximately 150 non-residential properties at risk of river flooding. 43% of residential properties and 45% of non-residential properties at risk are located within Potentially Vulnerable Areas.

Main areas at risk

The main areas which have greater than 20 residential properties at risk of river flooding are shown in Table 1.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Dingwall and Strathpeffer	40	£65,000
Alness	70	£65,000
Muir of Ord	20	£180,000

Table 1: Main areas at risk of river flooding

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding are estimated to be approximately £1.5 million. This accounts for around 6% of the Annual Average Damages for the Highland and Argyll Local Plan District. The damages are distributed as follows:

- 40% residential properties (£740,000)
- 20% non-residential properties (£300,000)
- 14% roads (£210,000)
- 11% agriculture (£160,000)
- 6% emergency services (£97,000)
- 1% vehicles (£21,000).

Figure 2 shows the location of Annual Average Damages from river flooding across the area. The area shown to have the highest damage is Muir of Ord. However, the outfall of Loch Ord is via a culvert, which is not well represented in the modelling or assessment of flood risk at present. As a result, flooding in Muir of Ord is potentially overestimated.

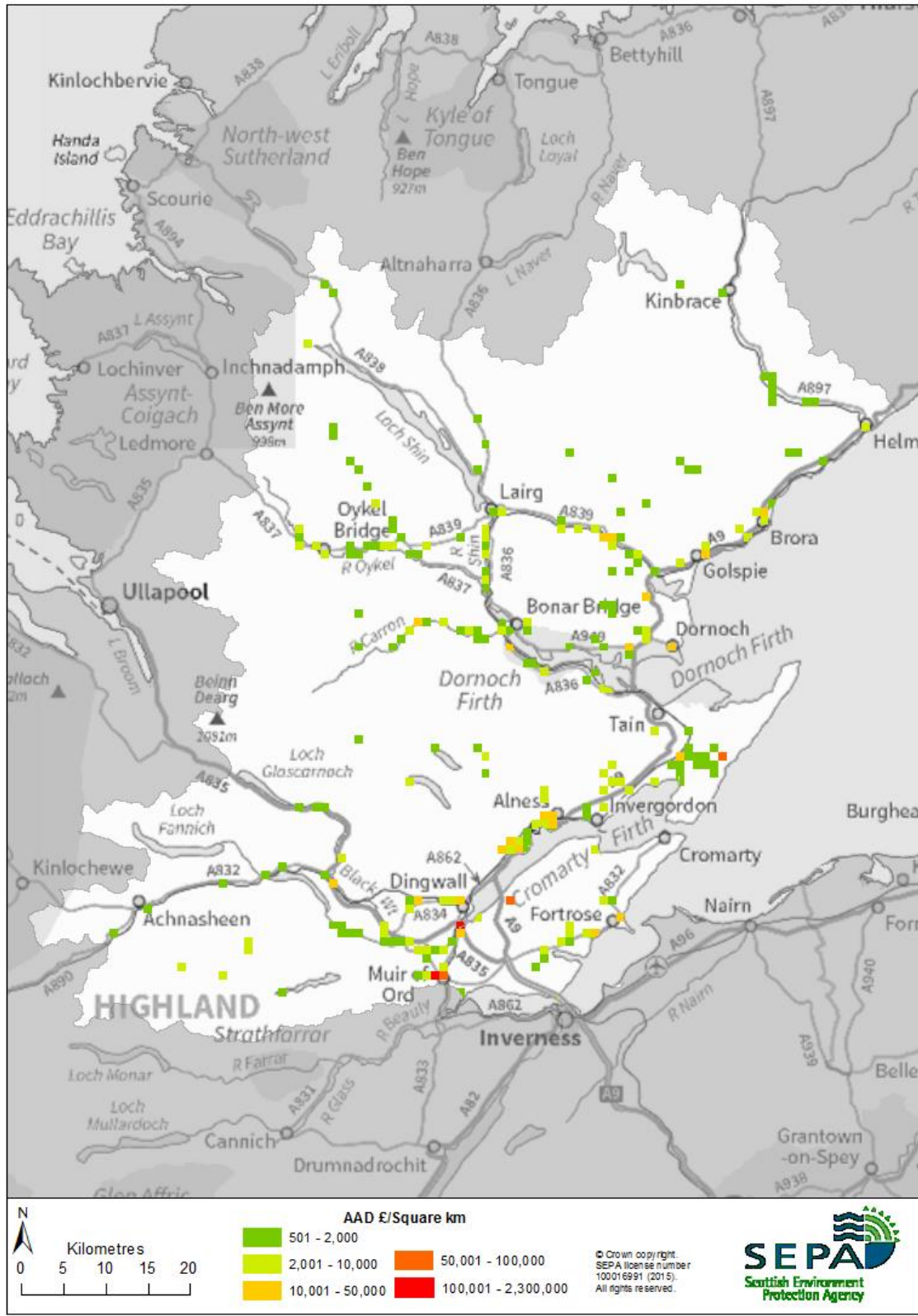


Figure 2: Annual Average Damages from river flooding

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

	Number at risk	Further detail
Community facilities	<10	Healthcare facilities
Utility assets	10	Includes; electricity substations and mineral/fuel extraction sites
Roads (excluding minor roads)	500 locations	Notably the A825 and A834
Railway routes	120 locations	Inverness to Wick
Agricultural land (km²)	128	n/a

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

Designated environmental and cultural heritage sites at risk

There are 66 cultural heritage sites at risk of river flooding. The sites include scheduled monuments (which include prehistoric domestic/defensive and ritual/funerary sites, chapels, bridges, and settlements) and listed buildings.

Approximately 56km² of environmental designated area is at risk of river flooding, including Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Sites of Special Scientific Interest (SSSI). Sites include Caithness and Sutherland Peatlands, Achanalt Marshes, Loch Eye, Glen Affric to Strathconon, Strath Carnaig and Strath Fleet Moors, and Mound Alderwood.

History of river flooding

Dingwall has been flooded from the River Peffery, though smaller water courses have also caused significant problems, such as in 2006.

Garve flooded from the Blackwater in 1960 and 1990.

Serious floods on the Conon in 1960/1970 instigated the construction of a flood embankment in Conon Bridge, which breached in a severe flood in 1989 and was then raised and strengthened in 1991.

The largest flood for 25 years occurred in March 2015 although the impacts were limited due to the effectiveness of flood warning and the existing flood defences. Livestock was lost in the upper Conon where agricultural embankments breached and widespread areas of low lying land, including farmland were flooded. This resulted in loss of livestock by three landowners at Scatwell. Moy Bridge was closed. There were reports of water entering the gardens of properties in Maryburgh, but no reports of property flooding internally.

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.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapter 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.

River flood warning schemes

There are 11 flood warning areas (Table 3, Figure 3) in this catchment group. These are areas where SEPA has forecast models to predict flooding on specific rivers. Note that in Table 3, this is not the number of properties at risk of flooding.

Flood warning area (FWA)	Number of properties within flood warning area	% of properties registered January 2014
Conon Bridge	89	74%
Contin	27	22%
Garve	56	61%
Lairg	18	72%
Moy Bridge	19	32%
Orrin	6	50%
Scatwell	7	71%
Strath Bran	1	0%
Strath Carron	110	26%
Strath Oykel	27	37%
Strathconon	33	30%

Table 3: Flood warning areas

The Highland Council has a flood monitor on the River Oykel by Oykel Bridge to give early warning of potential flooding.

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 Helmsdale, Shin and Conon catchment group may increase by 37%¹. This would potentially increase in the number of residential properties at risk of river flooding from approximately 290 to 430 and the number of non-residential properties from 150 to 190.

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.

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

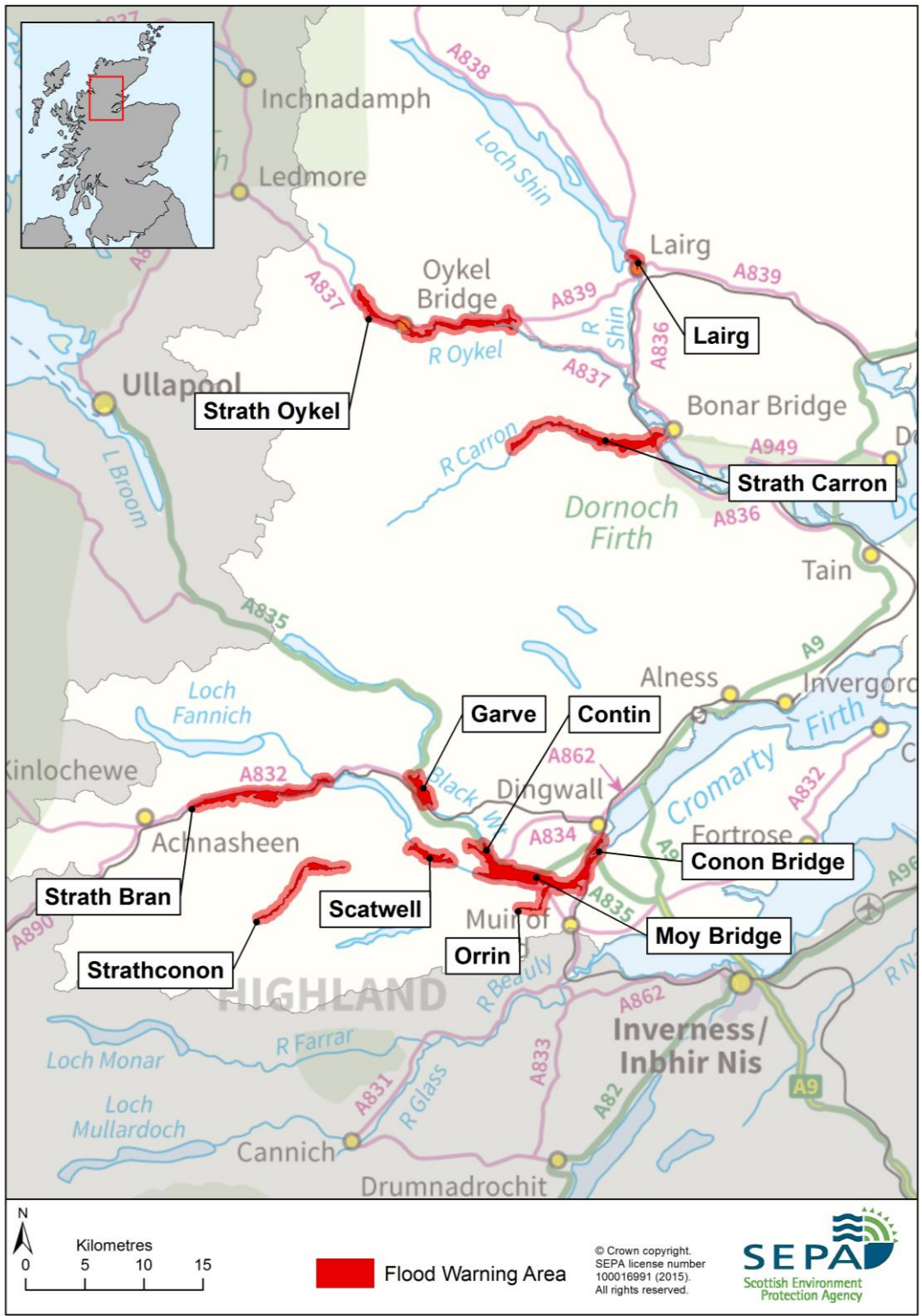


Figure 3: Flood warning areas

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 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.

Runoff reduction

There are widespread areas of potential for runoff reduction within the Helmsdale, Shin, and Conon catchment group. The areas of potential for runoff reduction are concentrated in the highland areas in the west of the catchment group. There is limited potential for runoff reduction either within the Potentially Vulnerable Areas closest to the coast (Golspie (01/06), Dornoch (01/07), Tarbat Ness (01/08) and Invergordon (01/09), or in the areas immediately adjacent to these Potentially Vulnerable Areas. It is therefore unlikely that runoff reduction measures would have any significant impact on flood risk within these Potentially Vulnerable Areas. However for the other Potentially Vulnerable Areas in this catchment group (Alness (01/10), Dingwall and Strathpeffer (01/14), Contin and Garve (01/15) and Conon Bridge and Muir of Ord (01/16)) there are significant areas of potential for runoff reduction, either within the Potentially Vulnerable Area or immediately adjacent. Therefore, for these Potentially Vulnerable Areas measures for reducing runoff could be considered further.

Floodplain storage

There are areas of potential for flood storage throughout the Helmsdale, Shin, and Conon catchment group, including within all the Potentially Vulnerable Areas. Due to the proximity of some of the areas for potential it is possible that floodplain storage measures outside of the Potentially Vulnerable Areas as well as within Potentially Vulnerable Areas may have a beneficial impact on flood risk within the Potentially Vulnerable Areas.

Sediment management

The River Fleet system is generally in approximate balance particularly in the upstream reaches, however on the Abhainn an t-Sratha Carnaig tributary there is more variation with areas of high erosion and deposition and the Garbh Allt tributary is predominantly erosional. The River Alness system is generally in approximate balance in its upstream reaches with some depositional reaches through the lochs (such as Loch Morie). However through Alness (01/10), the River Alness is much more erosional. The River Peffery, which runs through Dingwall and Strathpeffer (01/14), is generally in approximate balance in the vicinity of Strathpeffer but depositional in the vicinity of Dingwall. The sediment balance of the River Conon system is varied, with the majority in approximate balance however there are significant lengths of erosional and depositional reaches. The reaches through Conon Bridge and Muir of Ord (01/16) have a varied sediment balance, with significant lengths of highly eroding and depositing reaches. The potential for sediment management to provide significant flood risk improvements cannot be ruled out in this catchment group at this stage.

River flooding Ness and Beauly catchment group

Catchment overview

The Ness and Beauly river catchment group covers the central eastern area of the Highland and Argyll Local Plan District (Figure 1) and has an area of approximately 3,100km². The largest rivers are the River Beauly and River Ness. The Beauly drains the western part of the catchment group area and the River Ness the south and south west area. The north east of the catchment group area is drained by a series of small watercourses which tend to be flashy in nature and discharge directly into the Moray Firth.

The predominant land cover in the catchment is acid grassland, covering around 22% of the catchment area. Coniferous woodland, heather, and montane habitats all cover between 10-20% of the area.

The catchment contains five Potentially Vulnerable Areas:

- Nairn West and Ardersier (01/17)
- Nairn Central (01/18)
- Inverness Airport (01/19)
- Smithton and Culloden (01/20)
- Inverness and the Great Glen (01/21).

Flood risk

There are approximately 870 residential properties and 180 non-residential properties at risk of river flooding in this catchment group area. Approximately 83% of residential and 69% of non-residential properties at risk are within Potentially Vulnerable Areas.

Main areas at risk

The main areas, which have greater than 20 residential properties at risk of river flooding, are shown in Table 1. Note that the totals in Table 1 include the whole of the town of Nairn however a small part of Nairn is located in the Findhorn, Nairn and Speyside Local Plan District. Most of the properties at risk of river flooding in Nairn are located to the west of the River Nairn and are in the Highland and Argyll Local Plan District.

	Residential and non-residential properties at risk of flooding	Annual Average Damages
Inverness	530	£1,900,000
Nairn (total for Local Plan District 1 and 5) ¹	310	£310,000
Drumnadrochit	60	£87,000

Table 1: Main areas at risk of river flooding

¹ Nairn is split between two Local Plan Districts; Highland and Argyll and Findhorn, Nairn and Speyside. The numbers of properties listed in Table 1 as “at risk” in Nairn include the total number located in both Local Plan Districts.

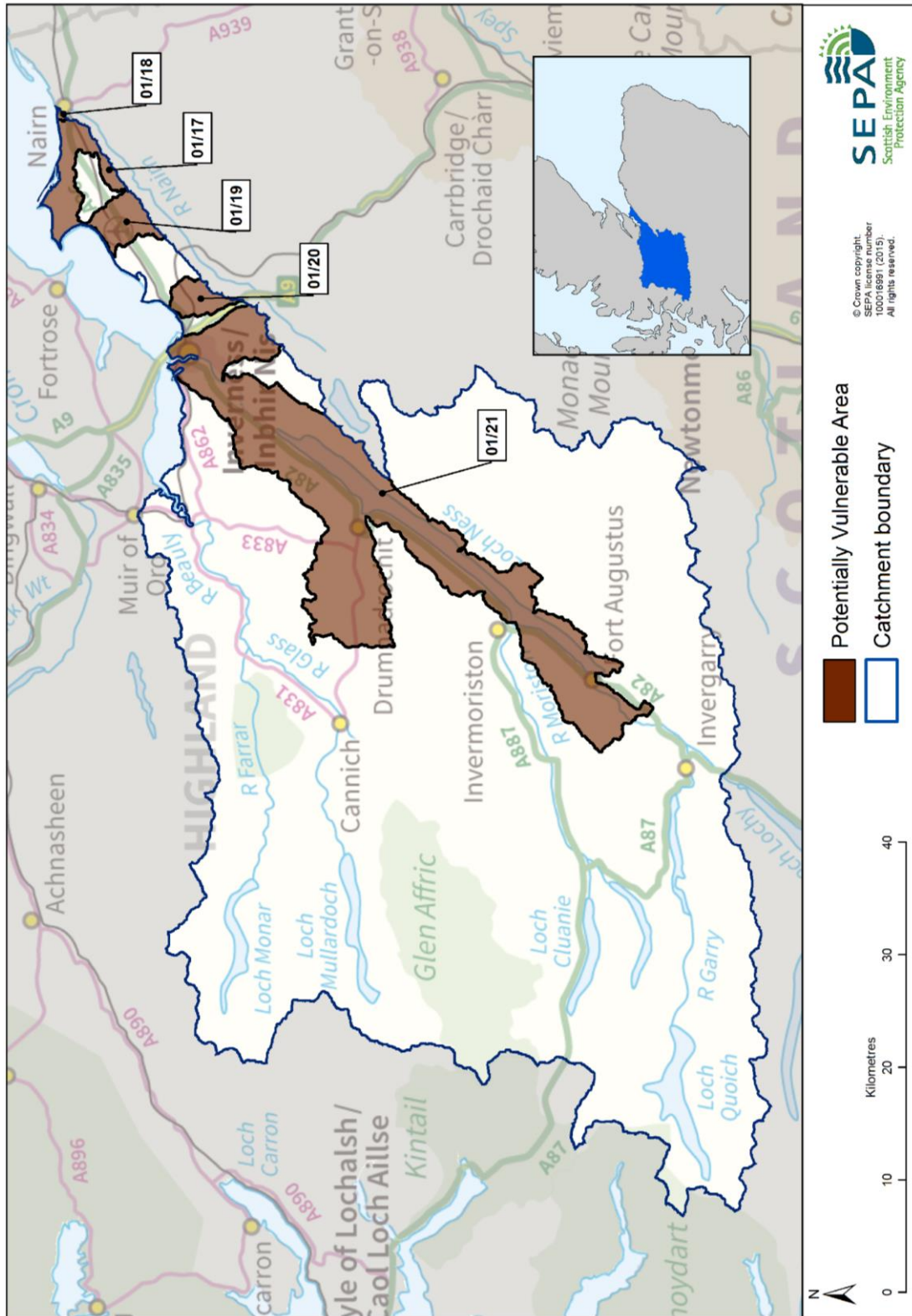


Figure 1: Ness and Beaully river catchment group area and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding are approximately £2.9 million. This accounts for 11% of the Annual Average Damages for the Highland and Argyll Local Plan District. The damages are distributed as follows:

- 61% residential properties (£1.8 million)
- 24% non-residential properties (£700,000)
- 6% emergency services (170,000)
- 4% agriculture (£130,000)
- 3% roads (£100,000)
- 2% vehicles (£60,000).

Figure 2 shows the location of Annual Average Damages from river flooding across the area. The area of highest damages is in Inverness.

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

	Number at risk	Further detail
Community facilities	0	n/a
Utility assets	10	Includes; electricity substations, fuel extraction sites and telephone exchanges
Roads (excluding minor roads)	390 locations	Notably the A887, A87 and A831
Railway routes	30 locations	Inverness to Wick, Inverness to Aberdeen, Inverness to Perth.
Agricultural land (km²)	68	n/a

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

Designated environmental and cultural heritage sites at risk

There are 56 cultural heritage sites at risk of flooding in the Ness and Beaully river catchment group. The sites include battlefields, gardens and designed landscapes, listed buildings and a large number of scheduled monuments.

Approximately 108km² of environmental designated area is at risk of river flooding, including Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Sites of Special Scientific Interest (SSSI). The sites include lochs, forests, glens, firths, hills, and rivers. The designated sites which have the largest areas flooded include West Inverness-shire Lochs, Strathglass Complex, Loch Ruthven, Glen Affric to Strathconon, Glen Strathfarrar, and Knockie Lochs.

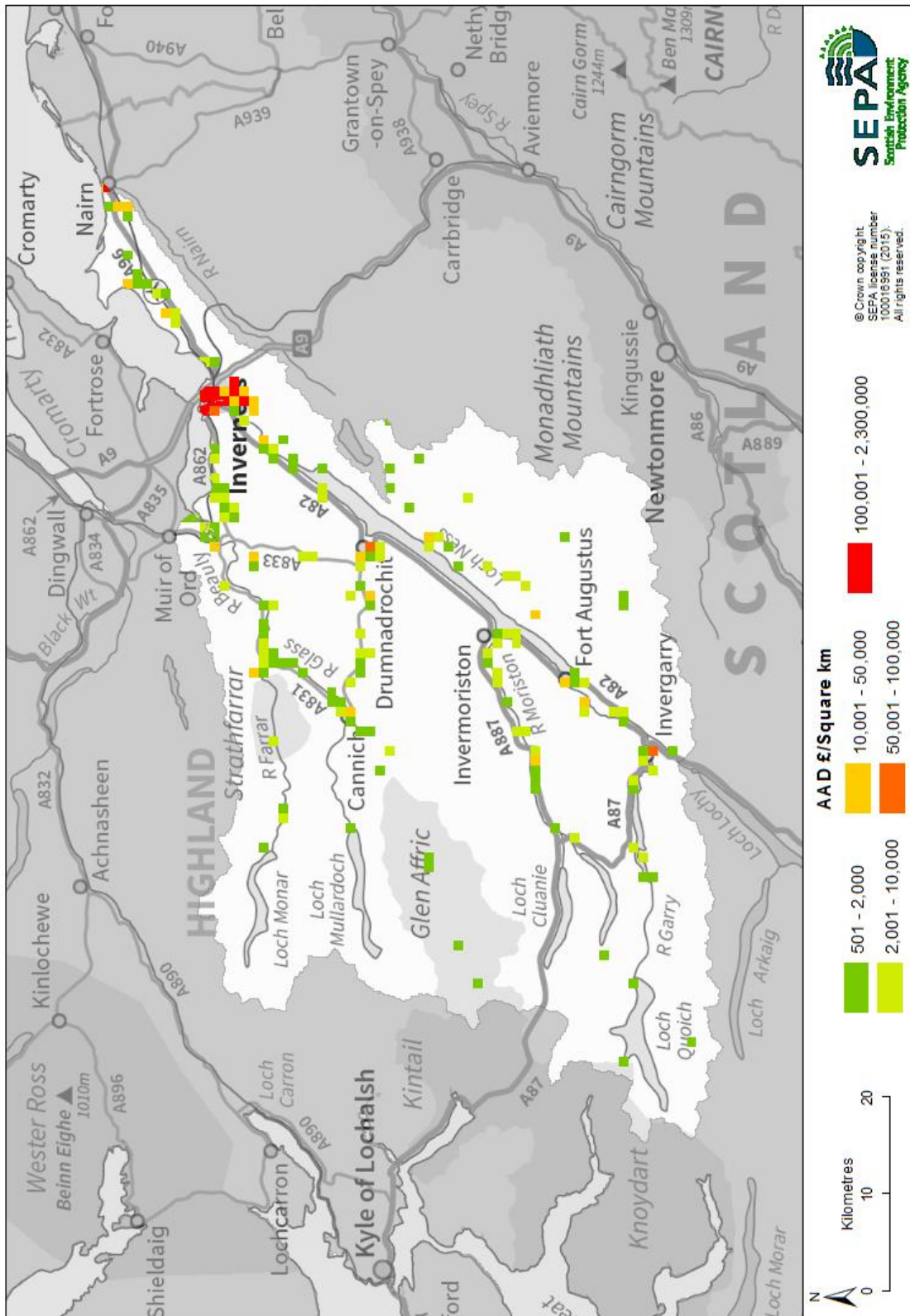


Figure 2: Annual Average Damages from river flooding

History of river flooding

Large floods occurred in Inverness in 1956 and 1989. Both floods caused extensive damage to the railway line. Fort Augustus was also affected in 1989. Watercourses, which have caused flooding, include the Mill Burn, River Ness, Culloden Burn and the Lochardil Burn, all located around Inverness. Flood defences since built in Inverness and Fort Augustus worked, as in 2015 (the largest flood since 1989) fewer properties were affected.

Highest recorded level at the SEPA gauge at Fort Augustus is 3.355m on 08/03/2015 (record from 1990-2015). During this flood, water entered the gardens of properties in The Riggs area. No reports of property flooding were received. During this flood, the Caledonian Canal breached at Bridge of Oich due to the spillway overtopping and causing scour to the embankment.

On 8th March 2015, following significant 48 hour rainfall totals combined with snowmelt there was widespread flooding to farmland and to low lying roads in the Beaully catchment, and flooding to Glen Affric Holiday Park, Cannich, and Lovat Bridge Caravan Park, where some residents were evacuated by boat.

On 8th March 2015, levels in the River Ness rose in response to persistent rain and snowmelt in the catchment. Ness Islands and Whin Park were flooded, as was Ladies Walk and Cavell Gardens. There were reports of property flooding at Island Bank Road, and a basement was flooded at a property at Ness Walk. Water was encroaching on Ness Bank and Bought Road.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters 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.

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.

River flood warning schemes

There are twelve flood warning areas for river flooding in the Ness and Beaully river catchment group, which are listed in Table 3. These are the areas where SEPA has detailed models to predict flooding on specific rivers. The flood warning areas are generally in the downstream reaches of the River Ness and River Beaully systems, including some of their tributaries such as the River Glass and the River Enrick. The locations of the flood warning areas are shown in Figure 3.

Flood warning area (FWA)	Number of properties within flood warning areas	% of properties registered January 2014
Aigas to Beaully	32	28%
Cannich	55	20%
Drumnadrochit	27	44%
Fasnakyle	2	100%
Glen Urquhart	16	44%
Invergarry	35	34%
Invermoriston	15	33%
Inverness	1,832	18%
Ness-side	36	42%
Strathglass	57	44%
The Riggs, Fort Augustus	39	41%
Nairn	92	33%
Inverness City (Ness Bridge to Friars Bridge)	692	n/a ²

Table 3: Flood warning areas

The Highland Council also has flood monitors on the following watercourses in this catchment to provide early warning of potential flooding:

- River Ness by the Greg Street footbridge
- Ault na Skiah just before the inlet structure to the South West Inverness Flood Relief Channel.
- Holm Burn on the Dores Road Bridge
- River Foyers on the road bridge over the river.

Awareness raising campaigns and community groups

The Glen Urquhart Land Use Partnership (GULUP) includes flood risk management in its remit.

² Flood warning area not operational until October 2014; sign-up statistics not available.

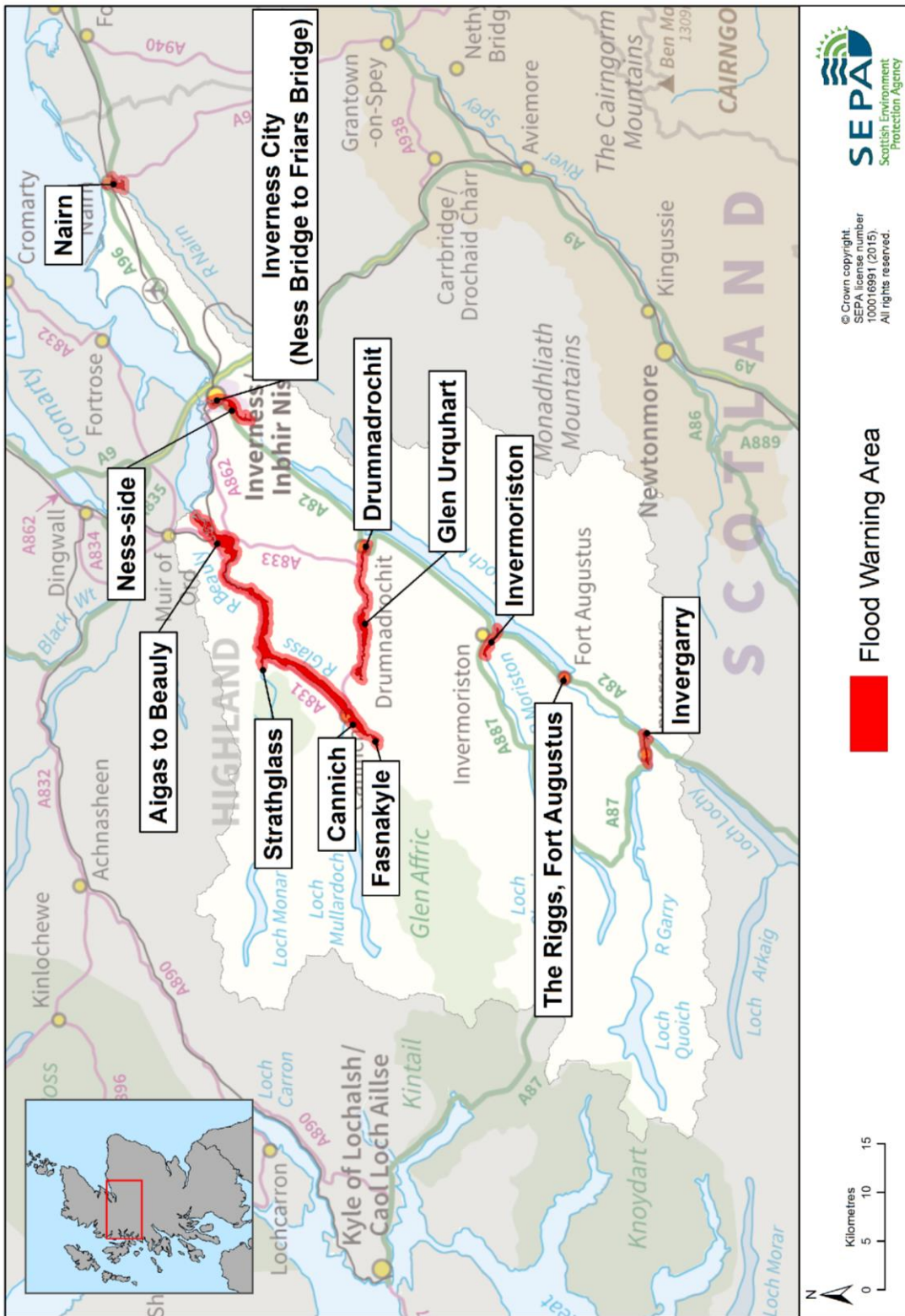


Figure 3: Flood warning areas

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 Ness and Beaully catchment may increase by 37%³. This would potentially increase in the number of residential properties at risk of river flooding from approximately 870 to 1,400 and the number of non-residential properties from approximately 180 to 230.

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 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.

Runoff reduction

There are widespread areas of potential for runoff reduction within the Ness and Beaully catchment group. The areas of potential for runoff reduction are concentrated in the highland areas in the south-west of the catchment group. There is limited potential for runoff reduction either within the Potentially Vulnerable Areas closest to the coast (Nairn West and Ardersier (01/17), Nairn Central (01/18), Inverness Airport (01/19), or Smithton and Culloden (01/20)) or in the areas immediately adjacent to these Potentially Vulnerable Areas. It is therefore unlikely that runoff reduction measures would have any significant impact on flood risk within these Potentially Vulnerable Areas. However for Inverness and the Great Glen (01/21) there are significant areas of potential for runoff reduction within and immediately adjacent to the southern half of the Potentially Vulnerable Area around Loch Ness.

Floodplain storage

There are areas of potential for flood storage throughout the Ness and Beaully catchment group, including within all the Potentially Vulnerable Areas. Due to the proximity of some of the areas for potential it is possible that floodplain storage measures outside as well as within the Potentially Vulnerable Areas may have a beneficial impact on flood risk in Potentially Vulnerable Areas. There are areas of potential for floodplain storage along the Loch Ness system including its tributaries

³ From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

such as the River Enrick at Drumnadrochit and associated lochs such as Loch Garry, Loch Loyne, Loch Cluanie, and Loch Cuaich. There are also areas of floodplain storage potential along the River Beaully and its tributaries and the River Nairn.

Sediment management

The sediment balance of the Loch Ness system is varied, whilst a significant proportion is in approximate balance there are also significant lengths of erosional reaches. Through the urban areas of Inverness the sediment balance of the watercourses tend to be in approximate balance. Localised areas of high erosion and deposition can contribute to flood risk and the potential for sediment management to provide significant flood risk improvements cannot be ruled out in this catchment at this stage.

River flooding Fyne, Firth Of Clyde, Awe and Etive, and Kintyre catchment group

Catchment overview

The Fyne, Firth of Clyde, Awe and Etive and Kintyre catchment group covers the south-west of the Highland and Argyll Local Plan District (Figure 1). It includes the islands of Jura, Colonsay, and Islay and has an area of approximately 5,200km². There are a large number of watercourses and burns in the catchment including the Loch Awe system and the River Add.

The predominant land covers in the catchment are heather grassland, coniferous woodland and acid grassland, which each provide around 20% of the total land cover of the area.

There are 10 Potentially Vulnerable Areas in this catchment all of which are located on the mainland:

- Oban (01/31)
- Loch Feochan (01/32)
- Taynuilt (01/33)
- Loch Awe (01/34)
- Craignish (01/35)
- Slockavullin (01/36)
- Inveraray (01/37)
- Lochgilphead (01/38)
- Tarbert (01/39)
- Campbeltown (01/40).

Flood risk in the catchment

There are approximately 740 residential properties and approximately 510 non-residential properties at risk of river flooding. 70% of the residential properties and 69% of the non-residential properties at risk are located within Potentially Vulnerable Areas.

Main areas at risk

The main areas, which have greater than 20 residential properties at risk of river flooding, are shown in Table 1. Campbeltown and Oban are the locations where most flood risk is concentrated in this catchment group area.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Campbeltown	400	£390,000
Oban	340	£1.5 million
Taynuilt	40	£60,000

Table 1: Main areas with a risk of flooding

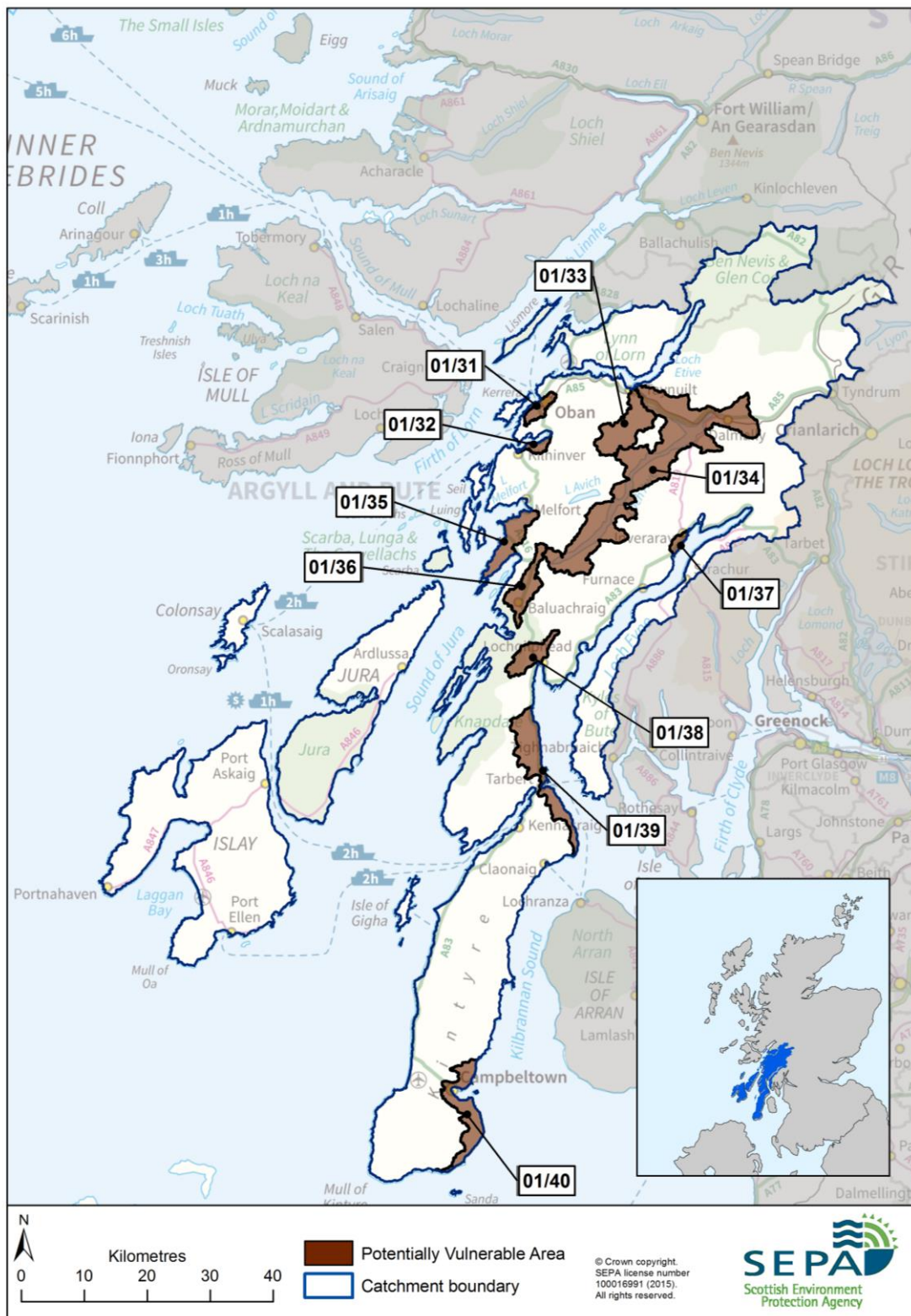


Figure 1: Fyne, Firth of Clyde, Awe and Etive, and Kintyre river catchment group and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding are estimated to be approximately £3.8 million. This accounts for around 14% of the total Annual Average Damages for the Highland and Argyll Local Plan District. The damages are distributed as follows:

- 47% non-residential properties (£1.8 million)
- 32% residential properties (£1.2 million)
- 8% emergency services (£300,000)
- 7% roads (270,000)
- 4% agriculture (£140,000)
- 2% vehicles (£70,000).

Figure 2 shows the location of Annual Average Damages from river flooding across the area. The areas of highest damage are in Oban and Campbeltown.

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

	Number at risk	Further detail
Community facilities	<10	Includes; educational buildings and emergency services
Utility assets	30	Includes; electricity substations, fuel extraction sites and telephone exchanges
Roads (excluding minor roads)	530 locations	Notably the A816 and A85
Railway routes	30 locations	Oban to Crianlarich
Agricultural land (km ²)	83	n/a

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

Designated environmental and cultural heritage sites at risk

There are approximately 96 cultural heritage sites at risk of flooding from rivers. The sites include numerous gardens and designed landscapes, a large number of scheduled monuments and listed buildings.

Approximately 51km² of environmental designated area is at risk of river flooding, including Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Sites of Special Scientific Interest (SSSI). The sites affected include lochs, moors, flats, dunes, forests, glens, hills, and coast. The designated sites which have the largest areas flooded include Rhinns of Islay, Glen Etive and Glen Fyne, Jura, Scarba, and the Garvellachs, Kintyre Goose Roosts and Lochs.

History of river flooding

There have been floods recorded in Oban and Campbeltown that led to significant impacts on properties and infrastructure, most recently in October 2014.

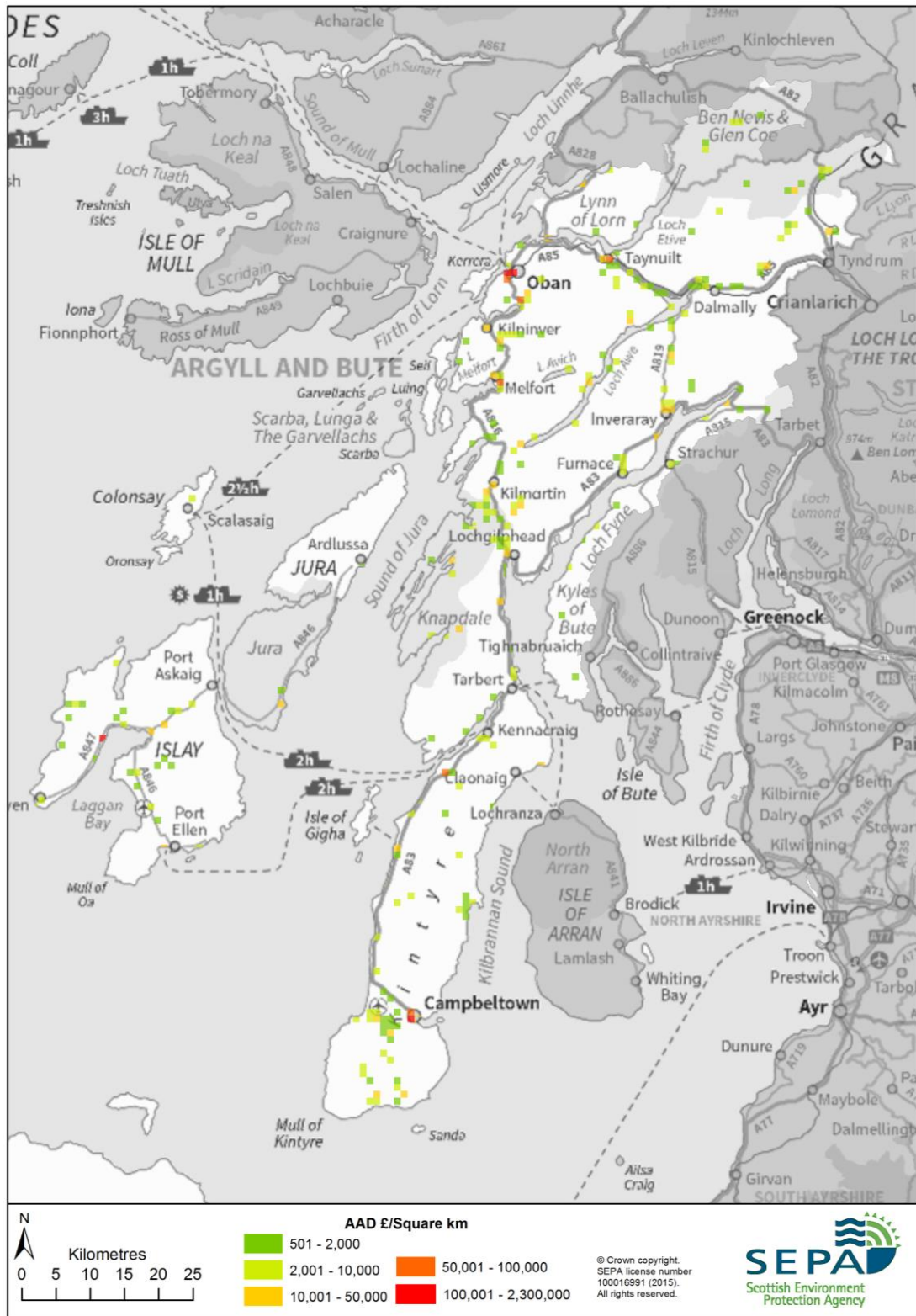


Figure 2: Annual Average Damages from river flooding

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 area are described in Section 2.

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 Fyne, Firth of Clyde, Awe and Etive, and Kintyre catchment may increase by 56%¹. This would potentially increase in the number of residential properties at risk of river flooding from approximately 740 to 1,200 and the number of non-residential properties from approximately 510 to 720.

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 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.

Runoff reduction

Almost all of the catchment group area has potential for runoff reduction. There are significant areas of potential for runoff reduction within and immediately adjacent to all 10 Potentially Vulnerable Areas.

Floodplain storage

There are scattered areas of potential for flood storage. The largest continuous area of high potential for floodplain storage is located around Loch Awe. Due to the

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

proximity of some of the areas for potential it is possible that floodplain storage measures outside as well as within the Potentially Vulnerable Areas may have a beneficial impact on flood risk within several of the Potentially Vulnerable Areas (Taynuilt (01/33), Loch Awe (01/34), Kilmartin (01/36), Lochgilphead (01/38) and Campbeltown (01/40)).

For the remaining Potentially Vulnerable Areas there is limited potential for floodplain storage either within or in the upstream areas adjacent to these Potentially Vulnerable Areas and it is unlikely that floodplain storage measures would have any significant impact on flood risk within these Potentially Vulnerable Areas.

Sediment management

The majority of the rivers in the area are in balance or moderately eroding, however there are areas with high erosion and deposition which could affect channel capacity. For example, the Soroba / Black Lynn Burn which passes through Oban has areas of deposition through the town, as well as erosion in the upper reaches.

River flooding Loch Linnhe, Lochy (Inverness-Shire) and Loch Shiel catchment group

Catchment overview

The Loch Linnhe, Lochy and Loch Shiel catchment group is located in the west of the Highland and Argyll Local Plan District (Figure 1) and has an area of approximately 3,700km². The largest river is the River Lochy, which flows from Loch Lochy to Loch Linnhe. Additional smaller rivers and burns flow into the many lochs spread across the catchment group or directly to the sea. The most significant lochs are Loch Shiel, Loch Arkaig, Loch Lochy, Loch Trieg, Loch Laggan and Loch Leven.

The predominant land cover in the area is acid grassland, covering around 33% of the catchment group area. Coniferous woodland, heather grassland and montane habitats each provide significant land cover, between 12-16% respectively.

The catchment group contains seven Potentially Vulnerable Areas that are generally located along or at the head of the sea lochs:

- Lochailort (01/22)
- Corpach (01/23)
- Caol and Inverlochy (01/24)
- Fort William (01/25)
- Sunart and Moidart (01/26)
- South Ballachulish (01/27)
- Ballachulish and Glencoe (01/28).

Flood risk in the catchment

There are approximately 180 residential properties and 90 non-residential properties at risk of river flooding. 31% of the residential and 29% of non-residential properties at risk are located within Potentially Vulnerable Areas.

Main areas at risk

The main areas, which have greater than 20 residential properties at risk of river flooding, are shown in Table 1.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Ballachulish	40	£140,000
Fort William	20	£42,000

Table 1: Main areas with a risk of flooding

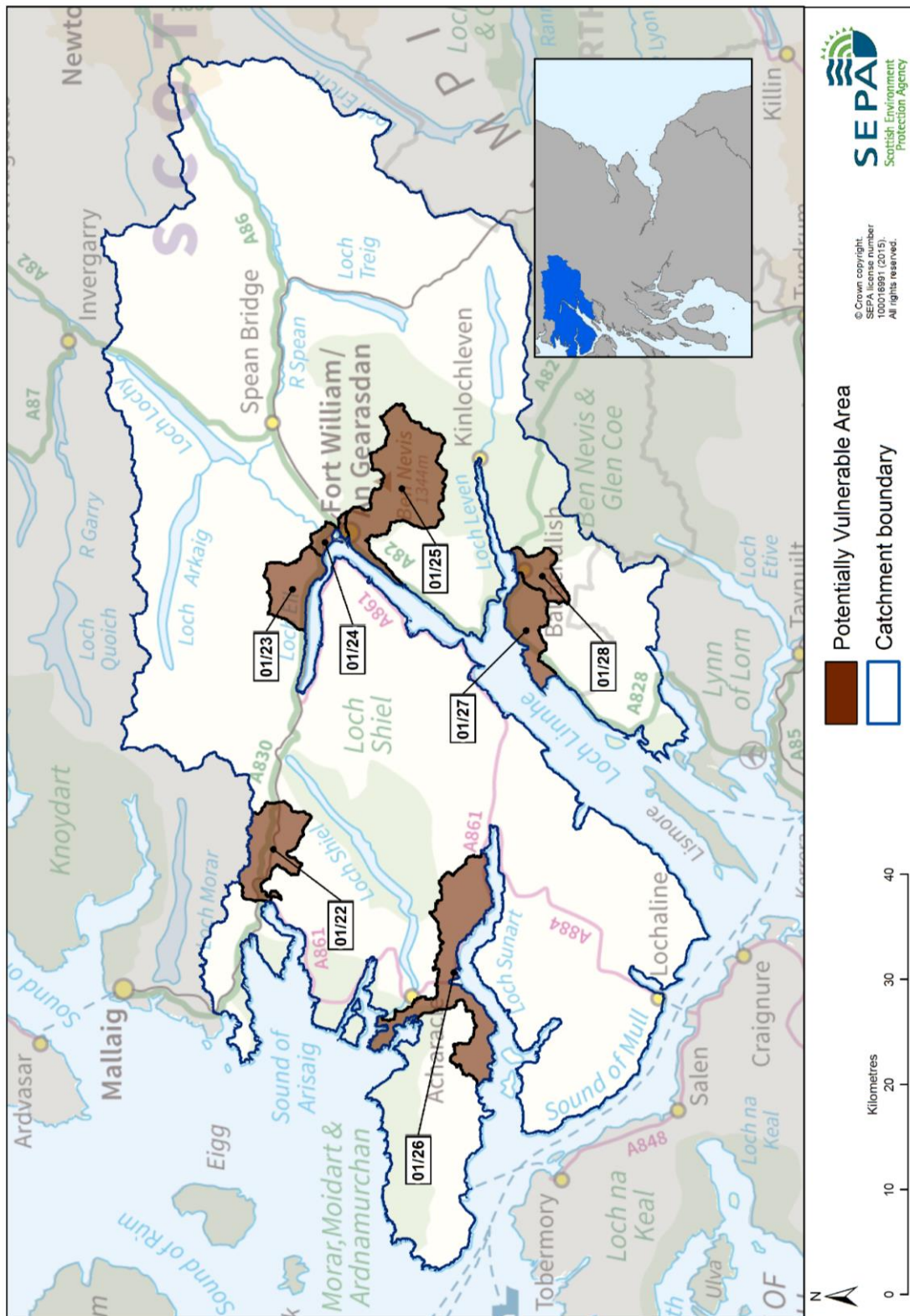


Figure 1: Loch Linnhe, Lochy (Inverness-shire), and Loch Shiel catchment group area and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding in this catchment group area are estimated to be £920,000. This accounts for around 3% of the Annual Average Damages for the Highland and Argyll Local Plan District. The damages are distributed as follows:

- 50% residential properties (£450,000)
- 18% non-residential properties (£170,000)
- 14% roads (£120,000)
- 10% agriculture (£93,000)
- 6% emergency services (£58,000)
- 2% vehicles (£20,000).

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 flooding within this catchment.

	Number at risk	Further detail
Community facilities	<10	Emergency services.
Utility assets	<10	Includes; electricity substations, fuel extraction sites and telephone exchanges.
Roads (excluding minor roads)	300 locations	Notably the A82 and A86.
Railway routes	50 locations	Crianlarich to Fort William, Fort William to Mallaig.
Agricultural land (km²)	60	n/a

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

Designated environmental and cultural heritage sites at risk

There are 63 cultural heritage sites at risk of flooding from rivers. The sites include the battlefields, numerous gardens and designed landscapes, listed buildings and a large number of scheduled monuments.

Approximately 80km² of environmental designated area is at risk of river flooding, including Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Sites of Special Scientific Interest (SSSI). The sites potentially affected include lochs, moss, forests, glens, hills, rivers and geological outcrops. The designated sites which have the largest areas potentially flooded include Loch Shiel, Rannoch Lochs, Moidart and Ardgour.

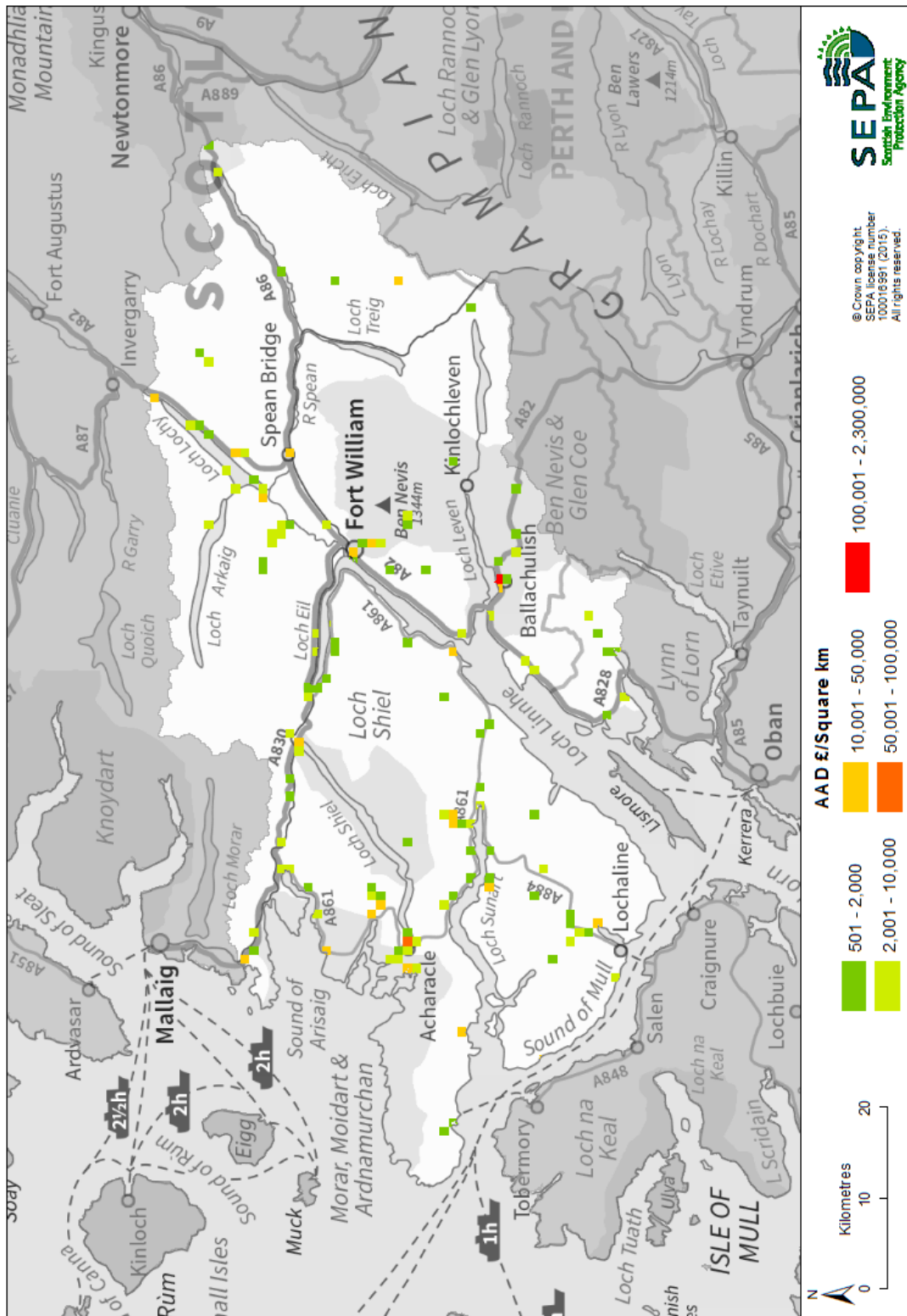


Figure 2: Annual Average Damages from river flooding

History of flooding

In this catchment area there are few records of flooding from rivers. In the past primarily roads have been affected by flooding. There are reports of flooding at Moss near Acharacle and at Lochyside in Fort William.

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.

River flood warning schemes

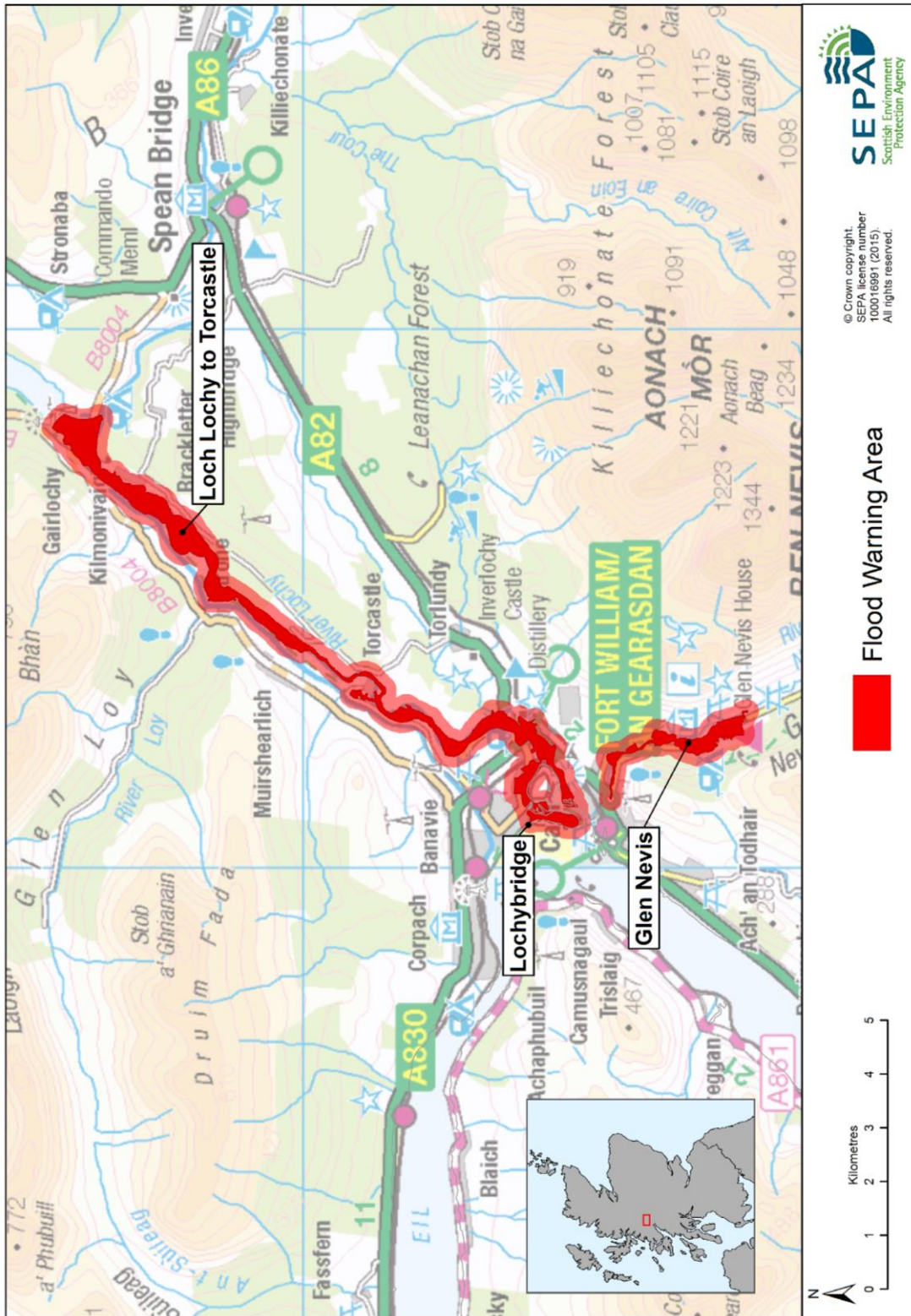
There are three flood warning areas for river flooding in the Loch Linnhe, Lochy, and Loch Shiel catchment group, which are listed in Table 3. These are the areas where SEPA has detailed models to predict flooding on specific rivers. The flood warning areas are in the Fort William area and are generally associated with the River Lochy and the River Nevis. The locations of the flood warning areas are shown in Figure 3.

Flood warning area (FWA)	Number of properties within flood warning areas	% of properties registered January 2014
Glen Nevis	33	42%
Loch Lochy to Torcastle	11	91%
Lochybridge	263	44%

Table 3: Flood warning areas

The Highland Council has two flood monitors in Fort William to provide early warning of potentially flooding.

- Flood monitor on Allt Dhomhnuill an t-Siucair by the Police Station.
- Flood monitor on unnamed burn on the culvert inlet by the leisure centre.



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 Flood Warning Area

Figure 3: Flood warning areas

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 Loch Linnhe, Lochy (Inverness-shire), and Loch Shiel catchment group area by 2080 may be in the order of 56%¹. This would potentially increase in the number of residential properties at risk of river flooding from approximately 180 to 330 and the number of non-residential properties from approximately 90 to 120.

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 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.

Runoff reduction

Almost the entire catchment group has potential for runoff reduction. There are significant areas with potential for runoff reduction within and immediately adjacent to all seven Potentially Vulnerable Areas in this catchment.

Floodplain storage

There are small scattered areas of potential for flood storage throughout catchment group. Due to the proximity of some of the areas for potential it is possible that floodplain storage measures outside as well as within the Potentially Vulnerable Areas may have a beneficial impact on flood risk in Lochailort (01/22), Caol and Inverlochy (01/24), and Sunart and Moidart (01/26)). There is limited potential for floodplain storage either within or in the upstream areas adjacent to (Corpach (01/23), Fort William (01/25), South Ballachulish (01/27), and Ballachulish and Glencoe (01/28)) and it is therefore unlikely that floodplain storage measures would have any significant impact on flood risk within these areas.

Sediment management

The Loch Eilt system passes through Lochailort (01/22) and has a varied sediment balance, with the loch typically undergoing deposition, with the area downstream

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

eroding. The River Laroach passes through Ballachulish and Glencoe (01/28) and is eroding in its upper reaches and depositing in the lower reaches through the town. The River Nevis system passes through Fort William (01/25) and is generally in approximate balance with some areas of erosion and to a lesser extent deposition. The potential for sediment management measures to provide significant flood risk improvements cannot be ruled out in this catchment group at this stage.

River flooding Loch Alsh, Loch Maree and Laxford catchment group

Catchment overview

The Loch Alsh, Loch Maree and Laxford catchment group covers the north-west part of the Highland and Argyll Local District Plan (Figure 1) and has an area of approximately 5,000km². It includes several larger lochs including Loch Morar, Loch Maree and Loch Assynt. There are numerous smaller rivers draining the steep slopes into lochs or directly to the sea.

Heather and grassland dominates the land cover accounting for around 70% of the total land cover in the area.

There are three Potentially Vulnerable Areas in the catchment:

- Lochinver (01/05)
- Poolewe (01/12)
- Kinlochewe (01/13).

Flood risk in the catchment

Main areas at risk

There are 150 residential properties and 90 non-residential properties at risk of river flooding. Properties at risk are dispersed around the catchment group. 10% of residential and 19% of non-residential properties are located within the Potentially Vulnerable Areas.

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding in this catchment group are estimated to be approximately £1.0 million. This accounts for around 4% of the Annual Average Damages for the Highland and Argyll Local Plan District. The damages are distributed as follows:

- 32% non-residential properties (£320,000)
- 30% residential properties (£300,000)
- 18% roads (£180,000)
- 14% agriculture (£140,000)
- 6% emergency services (£60,000)
- 1% vehicles (£8,000).

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

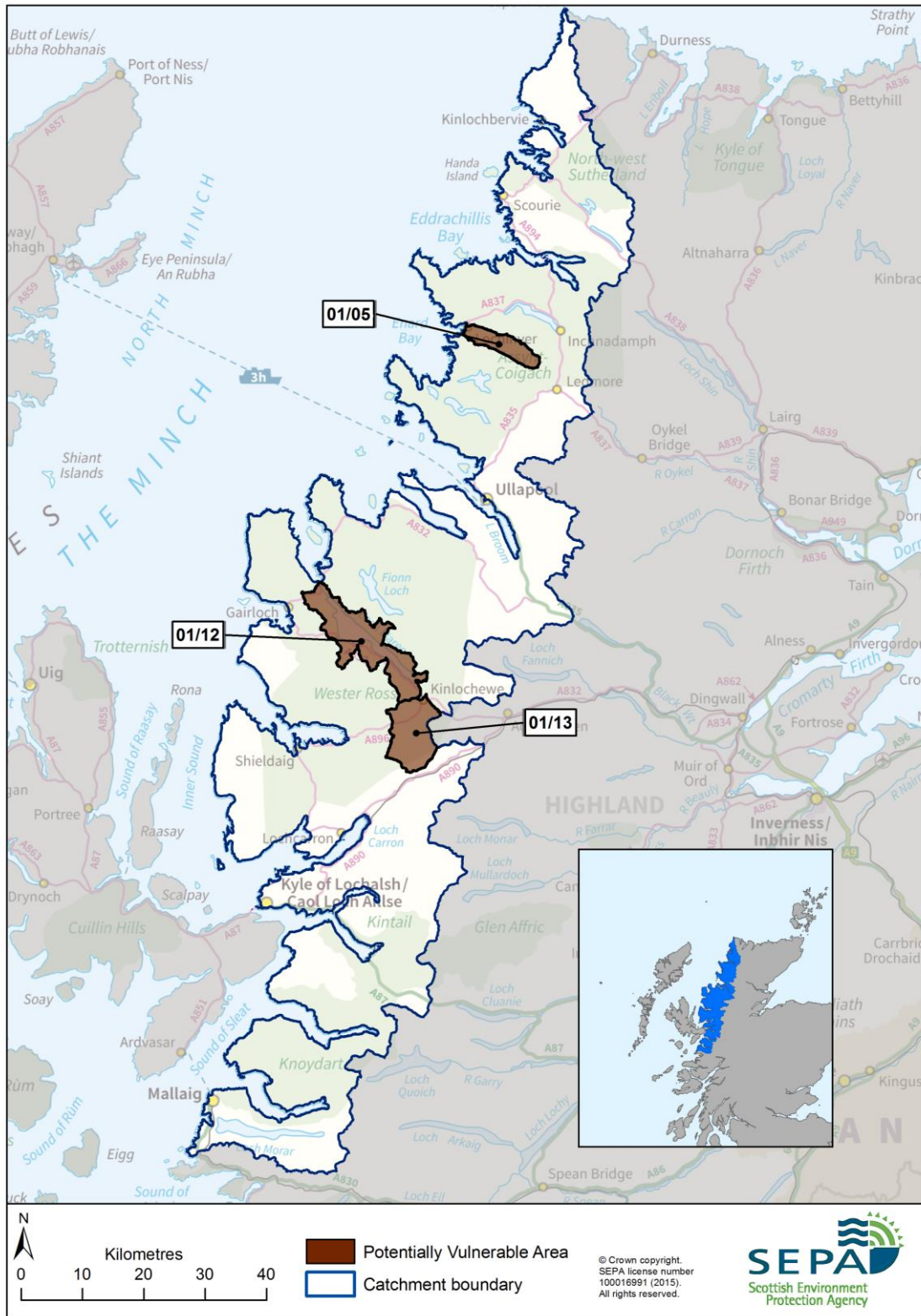


Figure 1: Loch Alsh, Loch Maree and Laxford catchment group area and Potentially Vulnerable Areas

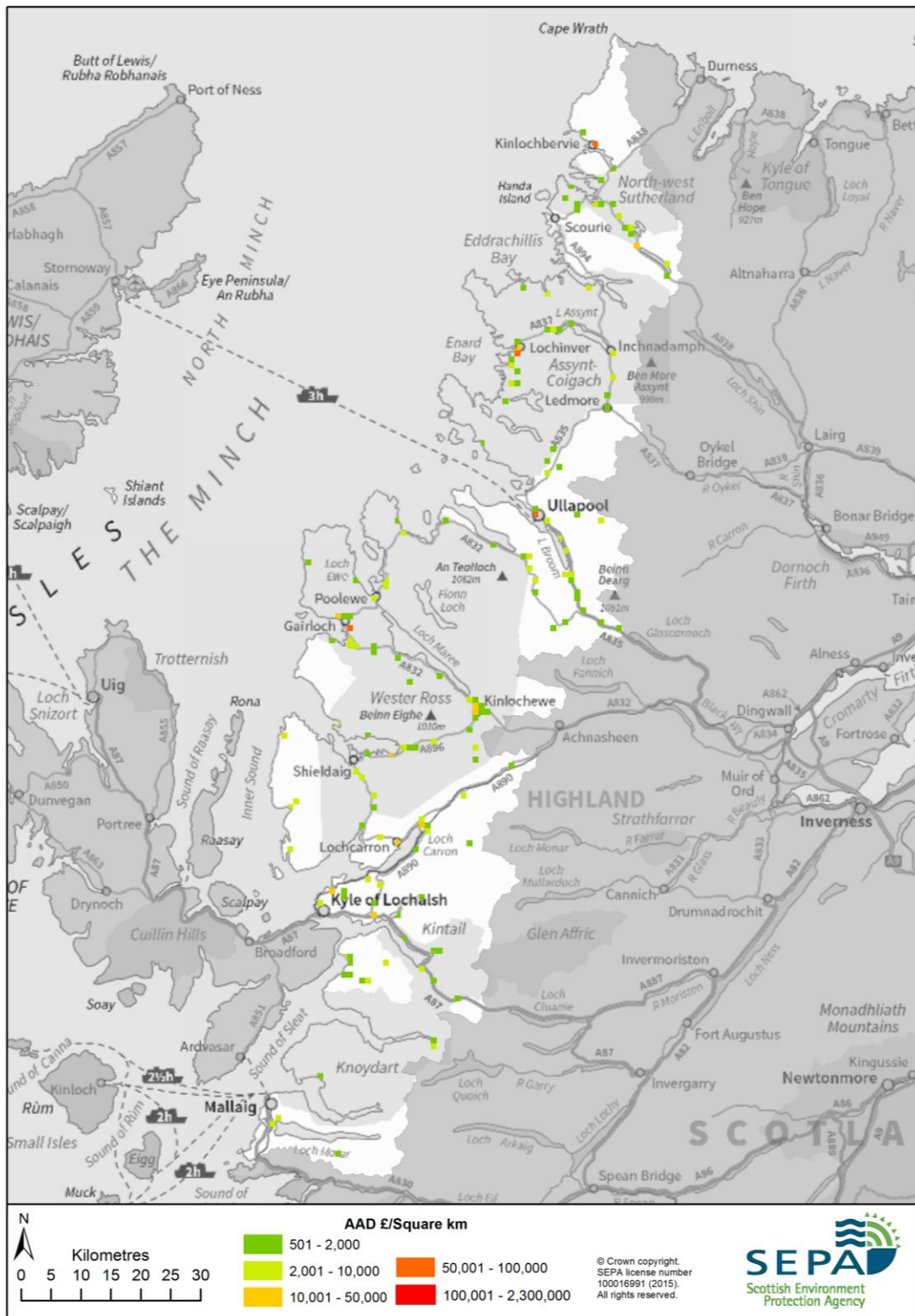


Figure 2: Annual Average Damages from river flooding

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

	Number at risk	Further detail
Community facilities	<10	Includes; educational buildings and emergency services
Utility assets	<10	Includes; electricity substations, fuel extraction sites and telephone exchanges
Roads (excluding minor roads)	350 locations	Notably the A835 and A896. Flooding to roads in this area can be significant in remote areas as there may be no alternative routes or long diversions
Railway routes	20 locations	Inverness to Kyle of Lochalsh
Agricultural land (km ²)	91	n/a

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

Designated environment and cultural heritage sites

There are approximately 22 cultural heritage sites at risk of river flooding. The sites include battlefields, gardens and designed landscapes scheduled monuments and listed buildings.

Approximately 280km² of environmental designated area is at risk of river flooding, including Special Areas of Conservation, Special Protection Areas, and Sites of Special Scientific Interest. The sites affected include lochs, forests, glens, hills, and rivers. The designated sites which have the largest flooded areas include Loch Maree, Loch Morar, Wester Ross Lochs and Ardlair-Letterewe.

History of river flooding

There are no records of extensive flooding in this area, however localised river flooding has affected parts of Kinlochewe and Lochinver. In August 2014, a number of properties were flooded and residents trapped in flooded houses after a river burst its banks on the A835 at Loch Broom near Ullapool. Five people were evacuated from Craig Bothy in Torridon by helicopter after being cut off by swollen rivers.

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 area are described in Section 2.

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 Loch Alsh, Loch Maree and Laxford catchment may increase by 56%¹. This would potentially increase in the number of residential properties at risk of river flooding from approximately 150 to 180 and the number of non-residential properties from approximately 90 to 110. 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 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.

Runoff reduction

Almost the entire catchment group has potential for runoff reduction due to the steepness of the slopes. There are significant areas of potential for runoff reduction within and immediately adjacent to all Potentially Vulnerable Areas, however even within these there are limited properties and infrastructure affected by flooding to justify significant interventions.

Floodplain storage

There are small scattered areas of potential for flood storage throughout the catchment group. The largest continuous areas of potential for floodplain storage are located around the lochs including Loch Morar, Loch Maree, Fionn Loch, Loch Assynt, Loch More and Loch Lurgainn. There is a large area of potential for floodplain storage associated with Loch Maree in the Poolewe Potentially Vulnerable Area (01/12) and it is possible that floodplain storage measures may have a beneficial impact on flood risk in this Potentially Vulnerable Area. However for the other Potentially Vulnerable Areas (Lochinver (01/05) and Kinlochewe (01/13)) there is limited potential for floodplain storage either within or adjacent to the Potentially Vulnerable Areas.

Sediment management

The river system, which passes through Lochinver (01/05), includes several lochs. These are mainly areas of deposition connected by watercourses, which are generally eroding. The Loch Maree system passes through Poolewe (01/12) and Kinlochewe (01/13) and has a highly variable sediment balance, with large sections in approximate balance.

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

River flooding Inner Hebrides catchment group

Catchment overview

The Inner Hebrides catchment covers the islands in the west of the Highland and Argyll Local Plan District. It includes the Isle of Mull and the Isle of Skye (Figure 1) and has an area of approximately 3,000km². Whilst there are no major rivers in this catchment group there are numerous small burns and lochs scattered throughout the catchment area.

The dominant land covers are bog, heather grassland, acid grassland and rough grassland, which between them cover almost 70% of the total area.

There are three Potentially Vulnerable Areas, two on the Isle of Mull and one on the Isle of Skye:

- Uig – Isle of Skye (01/11)
- Isle of Mull – Craignure (01/29)
- Ross of Mull (01/30).

Flood risk in the catchment

Main areas at risk

There are approximately 120 residential properties and approximately 70 non-residential properties at risk of river flooding. These are scattered across the area so that less than 5% of the residential and non-residential properties at risk are located within Potentially Vulnerable Areas.

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding are approximately £630,000. This accounts for around 2% of the total damages for the Highland and Argyll Local Plan District. The damages are distributed as follows:

- 51% residential properties (£320,000)
- 18% non-residential properties (£110,000)
- 13% roads (£80,000)
- 8% agriculture (£53,000)
- 6% emergency services (£39,000)
- 4% vehicles (£24,000).

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

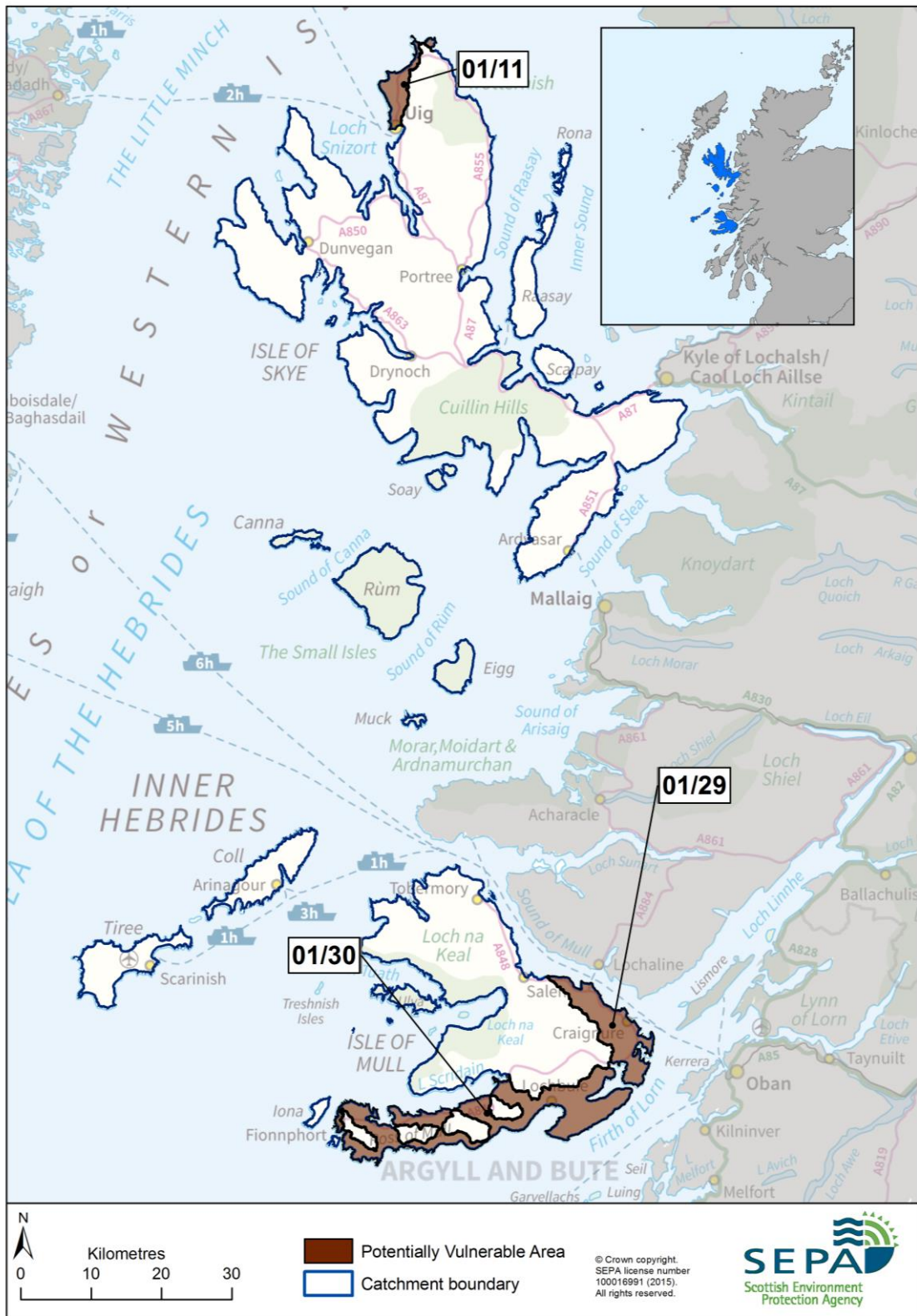


Figure 1: Inner Hebrides catchment group area and Potentially Vulnerable Areas

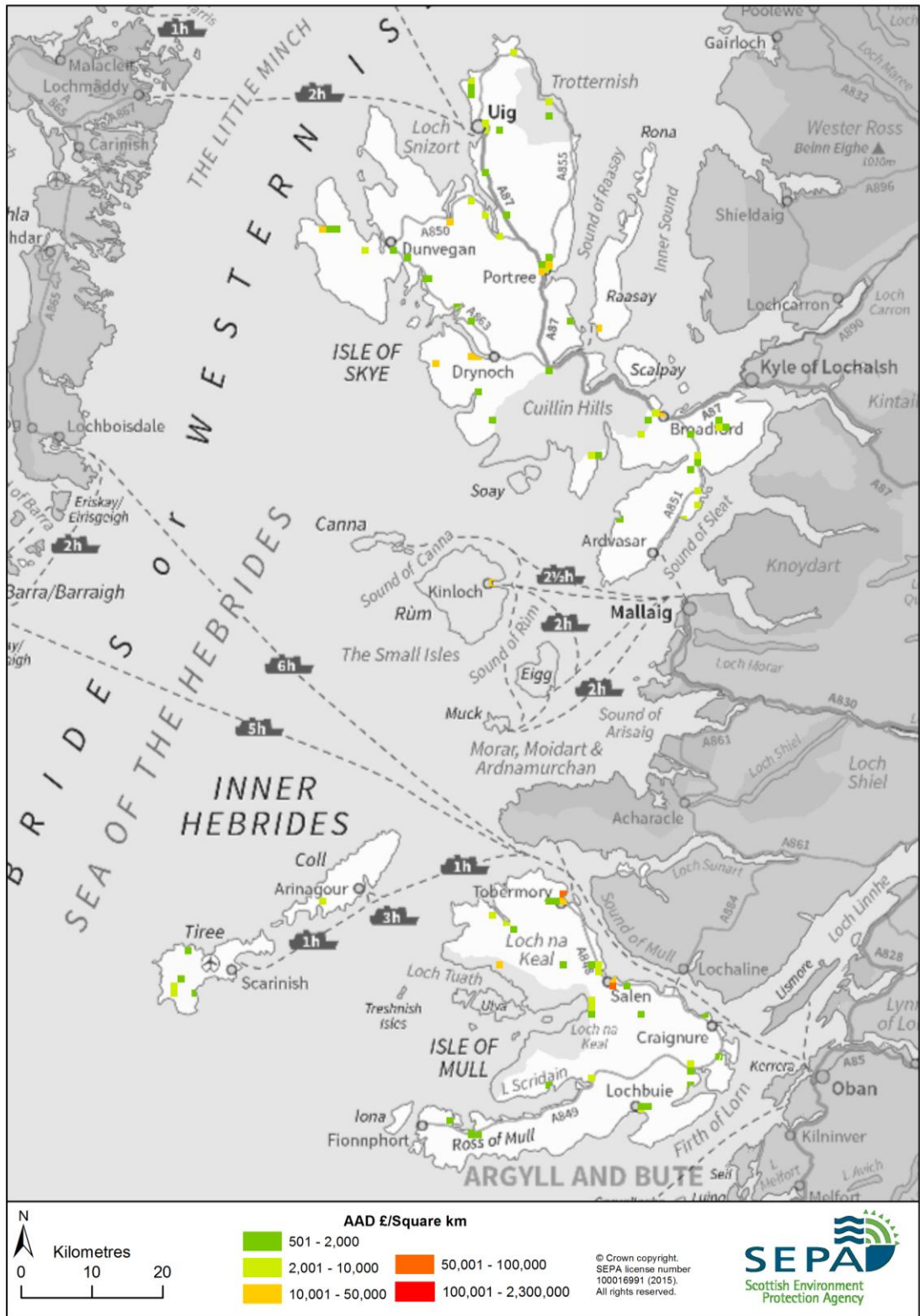


Figure 2: Annual Average Damages from river flooding

Table 1 shows the approximate numbers of further infrastructure assets which are at risk of flooding within this catchment.

	Number at risk	Further detail
Community facilities	0	n/a
Utility assets	<10	Includes; electricity substations and fuel/mineral extraction sites
Roads (excluding minor roads)	250 locations	Notably the A848 and A849
Railway routes	0	n/a
Agricultural land (km ²)	36	n/a

Table 1: Infrastructure and agricultural land at risk of river flooding

Designated environmental and cultural heritage sites at risk

There are 21 cultural heritage sites at risk from river flooding. The sites include gardens and designed landscapes, scheduled monuments (including prehistoric domestic/defensive and ritual/funerary sites, monastery, burial grounds, castles, bridges, and settlements) and listed buildings.

Approximately 28km² of environmental designated area is at risk of river flooding, including Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Sites of Special Scientific Interest (SSSI). The sites affected include lochs, bogs, peatlands, moors, forests, hills, and islands. The designated sites which have the largest areas at risk include Sligachan Peatlands.

History of river flooding

There are no records of extensive flooding of property in this area. However, localised river flooding can affect small clusters or individual properties and infrastructure in particular roads.

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 area are described in Section 2.

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 Inner Hebrides catchment group may increase by 56%¹. This would potentially increase in the number of residential properties at risk of river flooding from approximately 120 to 140. The number of non-residential properties would not change significantly under these conditions.

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 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.

Runoff reduction

Almost the entire catchment group has potential for runoff reduction. There are significant areas of potential for runoff reduction within and immediately adjacent to all Potentially Vulnerable Areas in this catchment. However, even within the Potentially Vulnerable Areas there are limited properties and infrastructure affected by flooding to justify significant interventions.

Floodplain storage

There are small scattered areas of potential for flood storage throughout the catchment group. There are no large continuous areas of potential for floodplain storage and there is limited potential for floodplain storage, either within or adjacent to Potentially Vulnerable Areas. It is therefore unlikely that floodplain storage measures would have any significant impact on flood risk within these Potentially Vulnerable Areas.

Sediment management

Due to the small size of river catchments in this area, no assessment of the potential for sediment management was undertaken.

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

3.3 Coastal flooding

Highland and Argyll Local Plan District

This chapter 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 the relevant Potentially Vulnerable Area chapters in Section 2.

In the Highland and Argyll Local Plan District, coastal flooding is reported across six coastal areas (Figure 1).

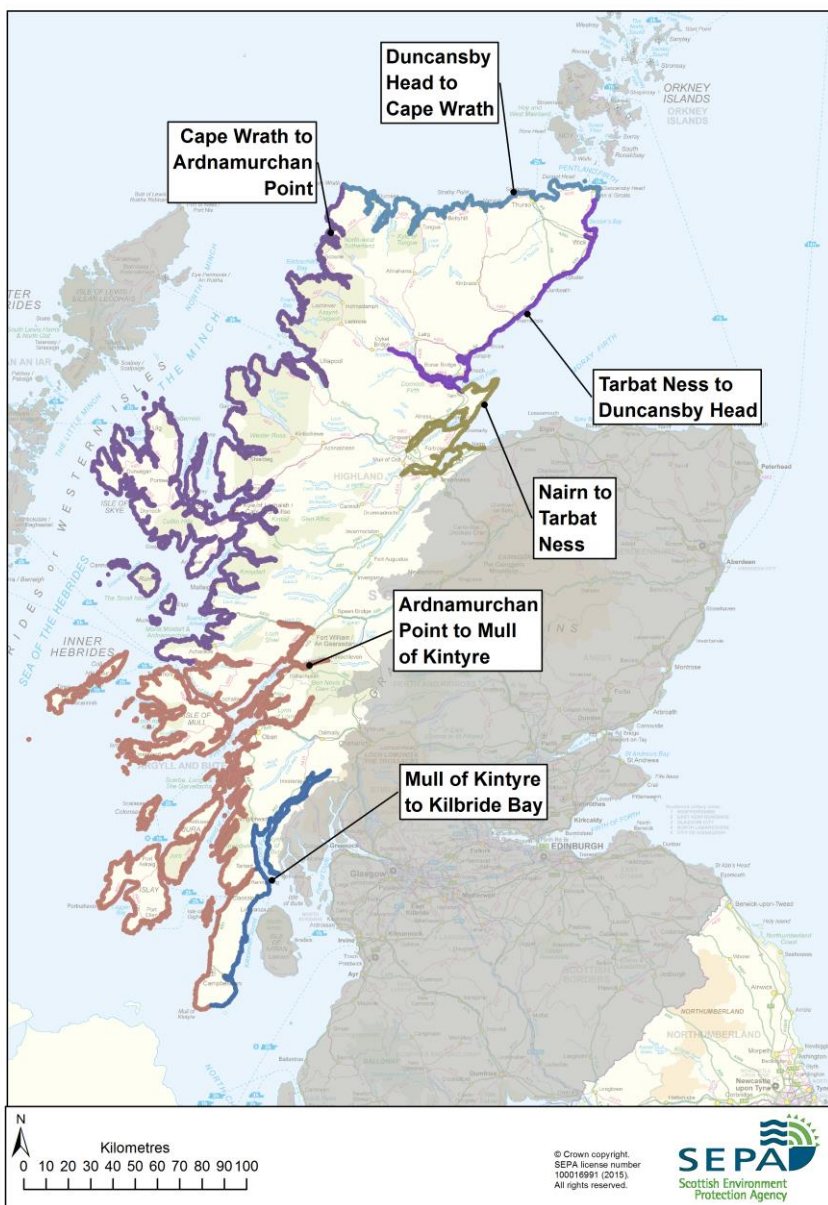


Figure 1: Coastal areas within the Highland and Argyll Local Plan District

Coastal flooding Nairn to Tarbat Ness

Coastal overview

The Nairn to Tarbat Ness coastal area is located at the west end of the Moray Firth extending from Nairn to Tain in the Dornoch Firth (Figure 1). It has a length of approximately 230km and includes the Cromarty Firth, Beauly Firth and the tidal section of the River Ness. The coastal area contains just one local authority, The Highland Council.

The Inner Moray Firth, Beauly Firth and Cromarty Firth have a relatively low exposure to waves and typically have a shallow foreshore often with a narrow shingle fringe along the shoreline. In the north, there are thin sand and shingle beaches at Shandwick, Balintore and Hilton of Cadboll which can suffer from episodic erosion during storms. There is significant erosion in the eastern side of this coastal area, at Nairn West Beach for example.

The River Conon flows into the Cromarty Firth and the River Beauly flows into the Beauly Firth. The River Ness flows into the eastern end of the Beauly Firth at South Kessock and is tidal through the northern part of Inverness. There are 10 Potentially Vulnerable Areas:

- 01/08: Tarbat Ness
- 01/09: Invergordon
- 01/10: Alness
- 01/14: Dingwall and Strathpeffer
- 01/16: Conon Bridge and Muir of Ord
- 01/17: Nairn West and Ardersier
- 01/18: Nairn Central
- 01/19: Inverness Airport
- 01/20: Smithton and Culloden
- 01/21: Inverness and the Great Glen.

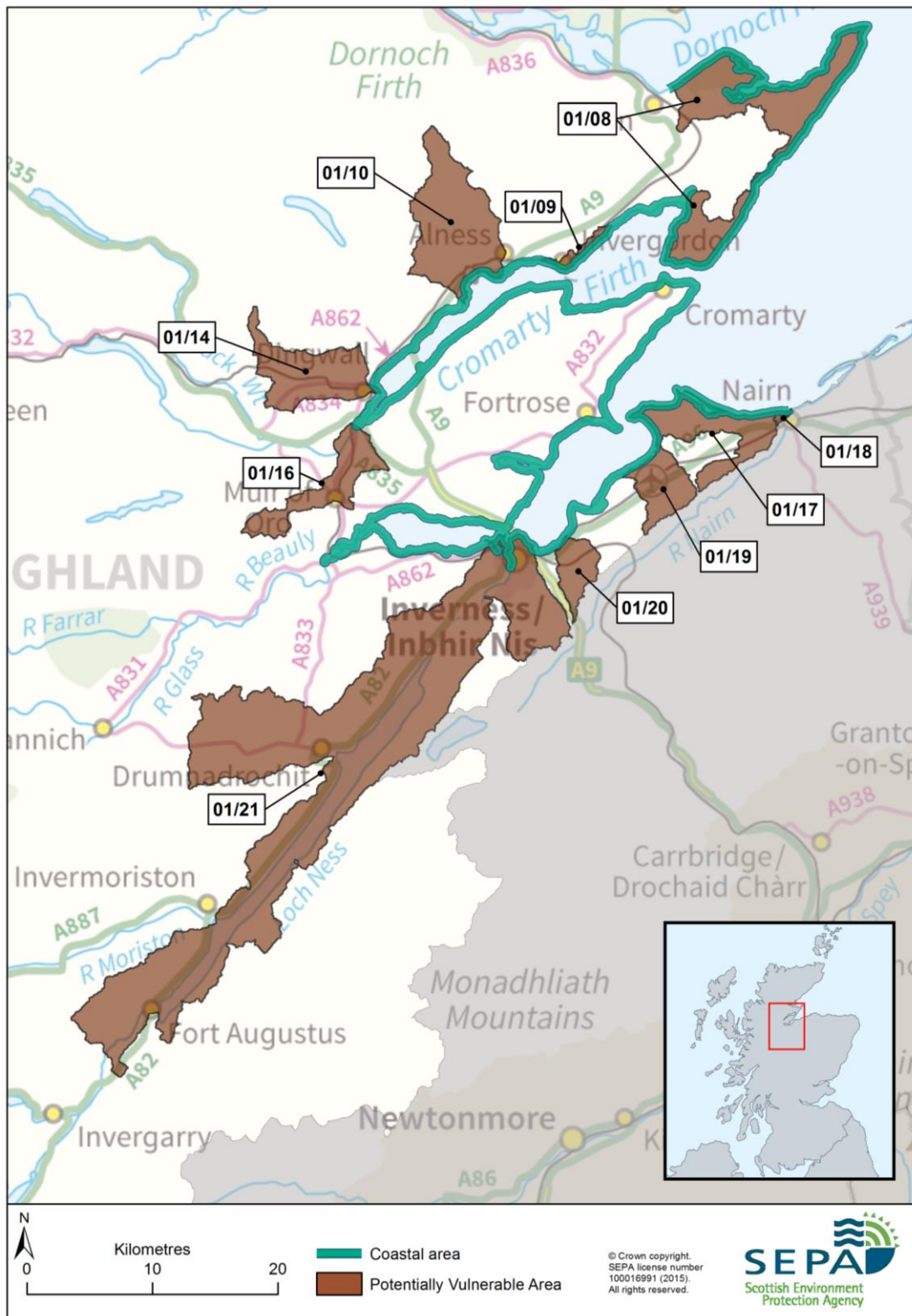


Figure 1: Nairn to Tarbat Ness coastal area and Potentially Vulnerable Areas in the Highland and Argyll Local Plan District

Flood risk in the coastal area

Within the Nairn to Tarbat Ness coastal area, there are approximately 730 residential properties and 160 non-residential properties at risk of coastal flooding. Approximately 90% of residential and non-residential properties at risk of flooding are located within the Potentially Vulnerable Areas.

Main areas at risk

The majority of the properties at risk of coastal flooding are located in Inverness and Nairn. Table 1 is a summary of the main areas which have the most properties at risk of coastal flooding within the coastal area. It also includes an estimate of the Annual Average Damages from coastal flooding for each area. Note that the totals in Table 1 include the whole of the town of Nairn however a small part of Nairn is located in the Findhorn, Nairn and Speyside Local Plan District. Most of the properties at risk of coastal flooding in Nairn are located to the west of the River Nairn and are in the Highland and Argyll Local Plan District.

	Number of residential and non-residential properties at risk of flooding	Annual Average Damages
Inverness	590	£3.0 million
Nairn (total for Local Plan Districts 1 and 5).	130	£200,000
Inver (Tarbat Ness)	50	£110,000
Avoch	40	£49,000
Ardersier	30	£14,000
Dingwall	20	£58,000

Table 1: Main areas at risk of coastal flooding

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the Nairn to Tarbat Ness coastal area are approximately £3.6 million. This accounts for around 14% of the total damages for the Local Plan District. The damages are distributed as follows:

- 52% non-residential properties (£1,900,000)
- 36% residential properties (£1,300,000)
- 5% emergency services (£190,000)
- 4% roads (£160,000)
- 1% vehicles (£51,000)
- 1% agriculture (£48,000).

Figure 2 shows the location of Annual Average Damages from coastal flooding across the area. The areas of highest damage areas are in Inverness and Nairn.

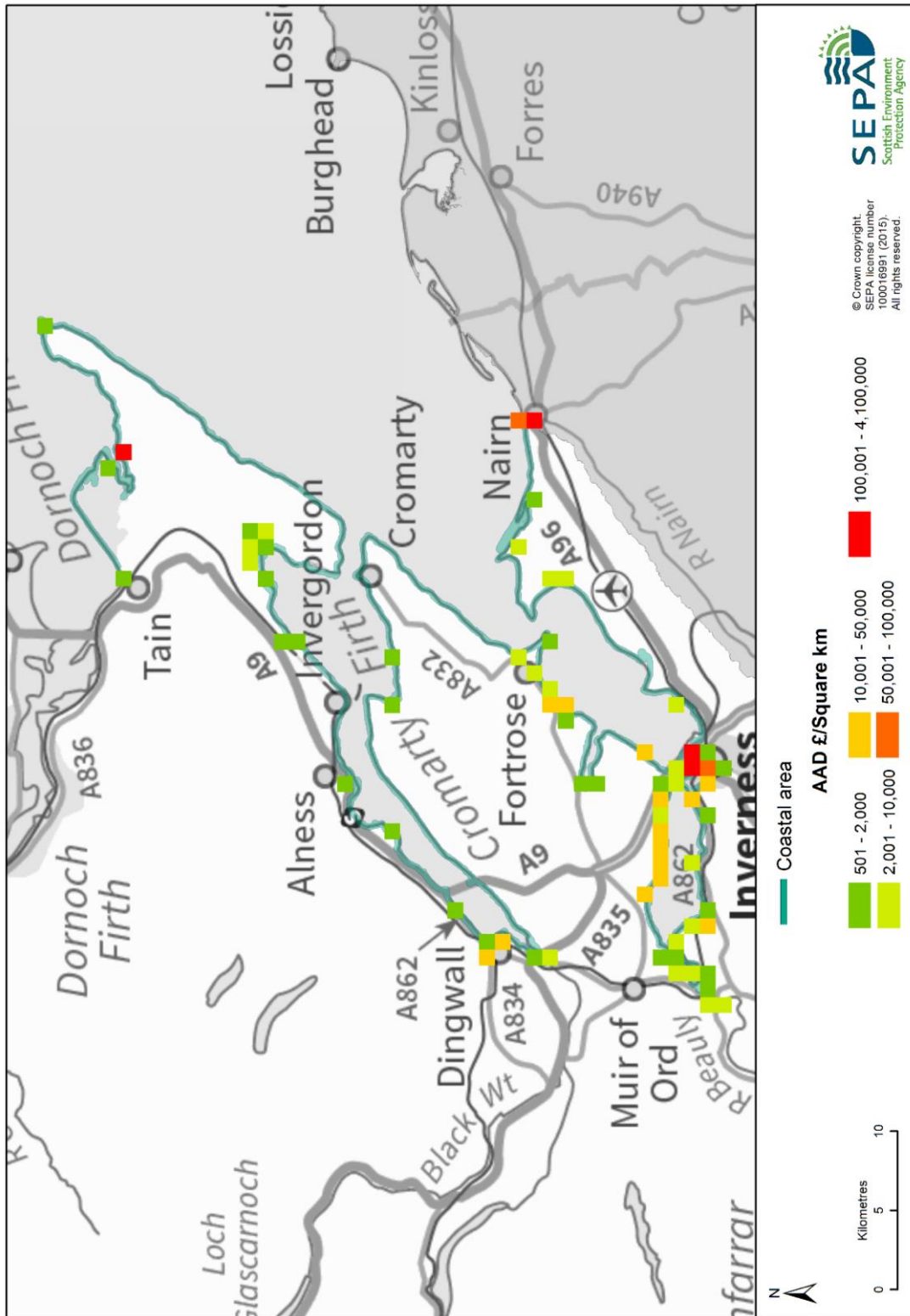


Figure 2: Annual Average Damages from coastal flooding

Table 2 shows further information about infrastructure and agricultural land at risk of coastal flooding.

	Number at risk	Further detail
Community facilities	<10	Includes; educational buildings and healthcare facilities.
Utility assets	30	Includes; electricity substations and fuel extraction sites.
Roads (excluding minor roads)	120	Notably; A96 and A832
Railway routes	27 locations	Aberdeen to Inverness, Inverness to Wick.
Agricultural land (km²)	14	n/a

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

Designated environmental and cultural heritage sites at risk

There are 13 designated cultural heritage sites at risk of coastal flooding. These sites include scheduled monuments, gardens and designed landscapes and listed buildings.

Approximately 26km² of environmentally designated area is at risk of coastal flooding, including Special Areas of Conservation, Special Protection Areas and Sites of Special Scientific Interest. The sites affected include Dornoch Firth and Morrich More, Whiteness Head, and Cromarty Firth.

History of coastal flooding

Large coastal floods were recorded in Inverness in 1956 and 1989 with both causing extensive damage to the railway line. There is a long history of smaller, more localised floods on the tidal sections of the River Ness and River Nairn, particularly when high tides coincide with high river flows.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapter in section 2 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.

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.

Coastal flood warning schemes

The Nairn to Tarbat Ness coastal area benefits from the Moray Firth Coastal Flood Warning Scheme. There are six flood warning areas: Portmahomack to Inver,

Rockfield to Balintore, Cromarty Firth, Rosemarkie to Avoch, Beaully Firth, Inverness Harbour and South Kessock and Ardersier to Nairn (Figure 3).

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 Nairn to Tarbat Ness coastal area is 0.5m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 730 to 1,300 and the number of non-residential from approximately 160 to 670. 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

The main area of potential for estuarine surge attenuation within the Cromarty Firth is on the north bank around Invergordon (01/09). Additionally there is a small area of potential around Nigg Ferry (Tarbat Ness - 01/08). Within the Beaully Firth the north bank shows more potential than the south bank. There are areas of potential along the coastlines of Inverness and the Great Glen (01/21) and Nairn West and Ardersier (01/17).

Wave energy

There is potential for wave energy dissipation along the majority of the coastline in this coastal area. There are significant areas of potential for wave energy dissipation around Inverness Airport, Inverness, the Beaully Firth, and the Cromarty Firth. The south-east facing stretches of coast such as Longman Point to Blue Head, and North Sutor to Tarbat Ness show scattered potential. The urban areas of Nairn and Invergordon also have potential for wave energy dissipation.

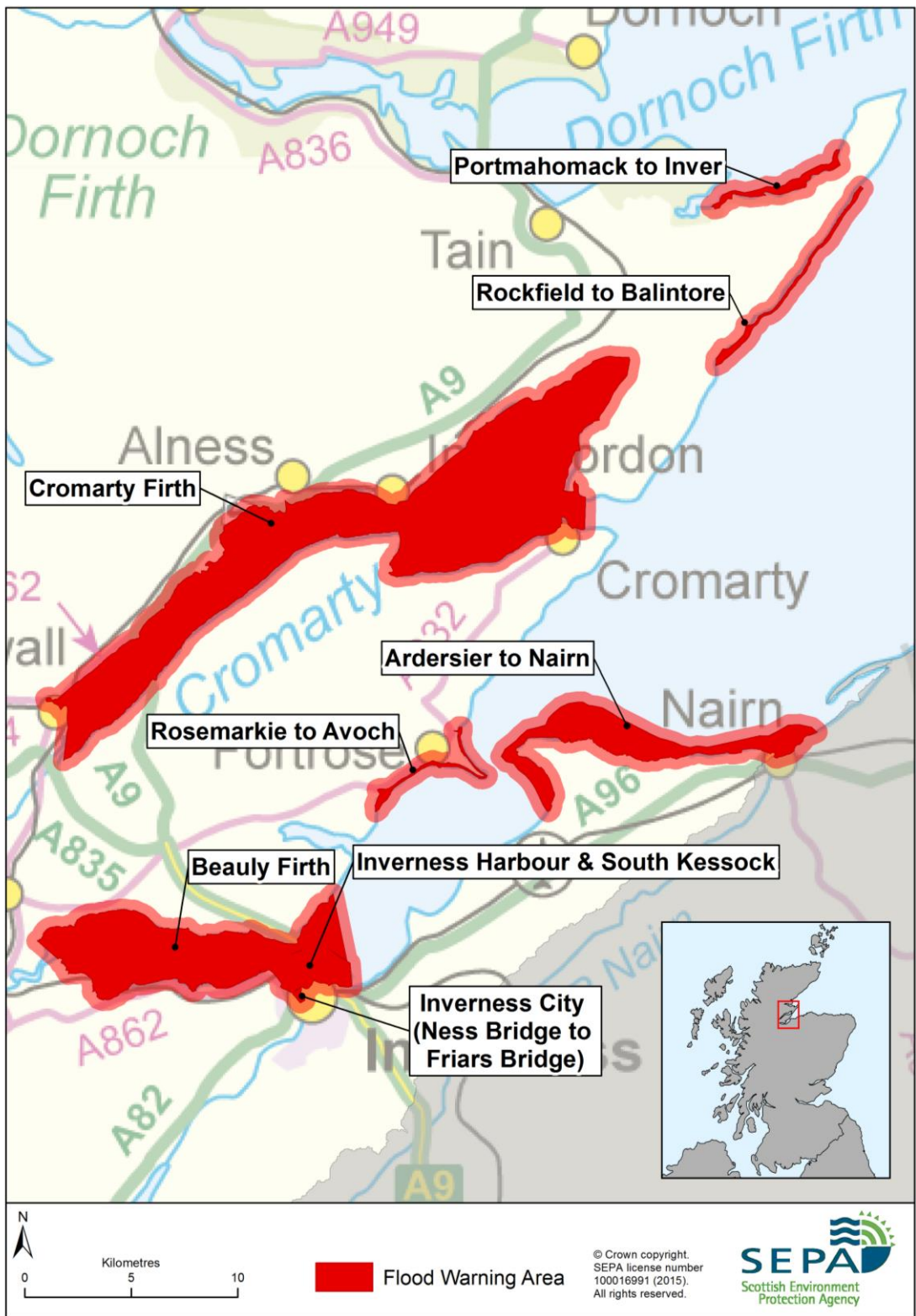


Figure 3: Coastal flood warning areas

Coastal flooding Tarbat Ness to Duncansby Head

Coastal overview

The Tarbat Ness to Duncansby Head coastal area has a length of approximately 180km and extends from Tarbat Ness at the mouth of the Dornoch Firth in the south to Duncansby Head (Freswick Bay) in the north (Figure 1). There are several towns and villages located close to the coastline including Wick, Lybster, Dunbeath, Helmsdale, Brora, Golspie, Dornoch and Tain.

In the south, the Dornoch Firth is an area of relatively sheltered coastline with extensive sand and mudflats with some saltmarsh. North of the Dornoch Firth are long sandy beaches, for example at Dornoch, Golspie and Brora. Further north still, the coastline typically comprises cliffs with a series of small coastal bays and rocky outcrops.

The Wick River, Dunbeath Water, Langwell Water, River Helmsdale, River Brora and the Kyle of Sutherland (Dornoch Firth) all discharge to the North Sea along this stretch of coastline.

There are five Potentially Vulnerable Areas:

- 01/02: Wick Airport
- 01/03: Wick: Burn of Newton
- 01/04: Wick Coastal
- 01/06: Golspie
- 01/07: Dornoch.

Flood risk in the coastal area

Main areas at risk

Within the Tarbat Ness to Duncansby Head coastal area, there are approximately 20 residential properties and 20 non-residential properties at risk of coastal flooding. Approximately 95% of residential properties and 50% of the non-residential properties at risk of flooding are located within Potentially Vulnerable Areas. All the residential properties are located within the Golspie Potentially Vulnerable Area (01/06).

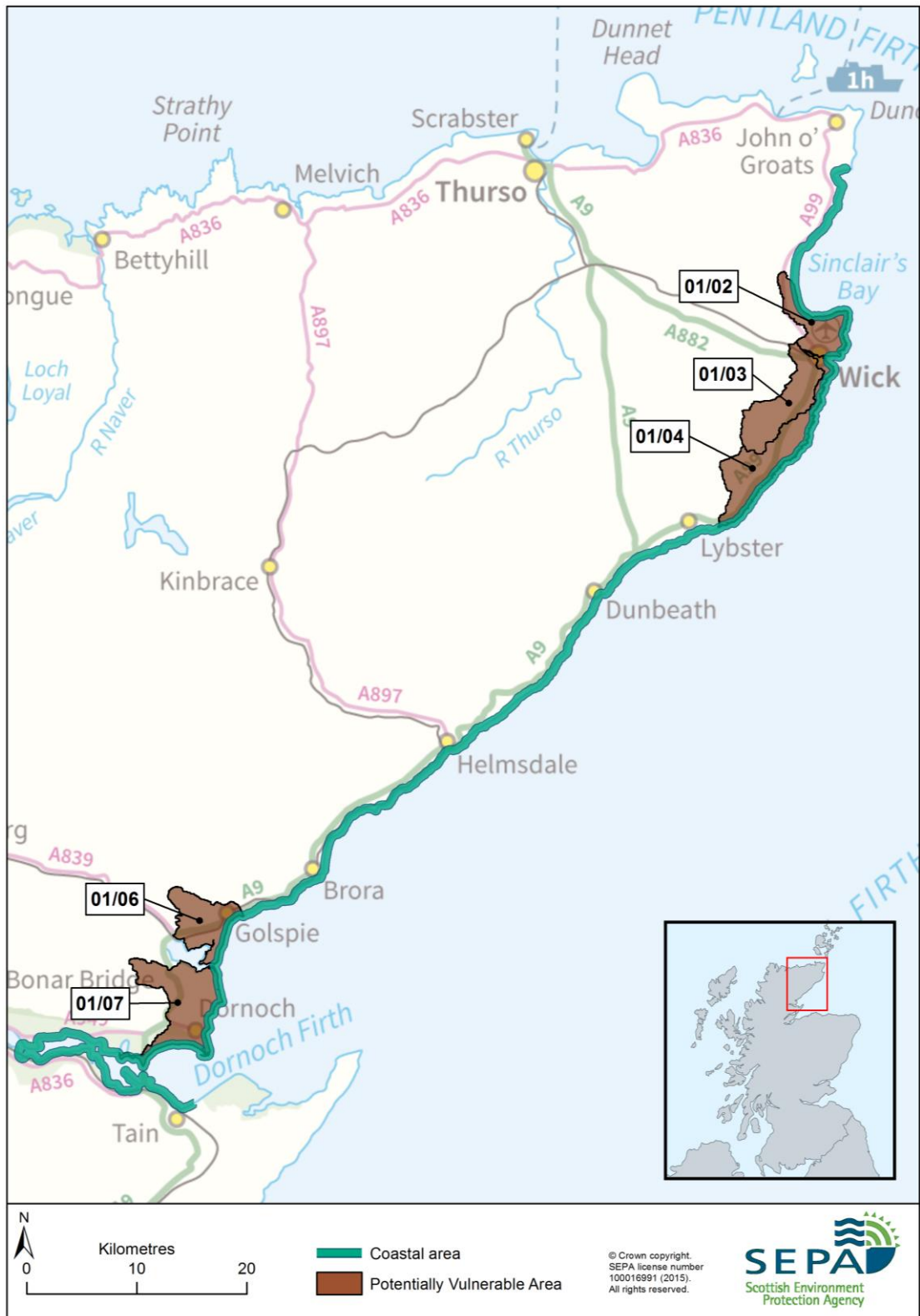


Figure 1: Tarbat Ness to Duncansby Head coastal area and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages caused by coastal flooding within the Tarbat Ness to Duncansby Head coastal area are approximately £230,000. This accounts for around 1% of the total damages for the Local Plan District. The damages are distributed as follows:

- 37% non-residential properties (£86,000)
- 31% residential properties (£72,000)
- 17% roads (£39,000)
- 7% emergency services (£16,000)
- 5% agriculture (£12,000)
- 2% vehicles (£5,300).

Figure 2 shows the Annual Average Damages throughout the coastal area. The area with the highest damages is in Golspie.

Table 1 shows further information about infrastructure and agricultural land at risk of coastal flooding.

	Number at risk	Further detail
Community facilities	<10	Emergency services
Utility assets	0	n/a
Roads (excluding minor roads)	40	Notably the A9
Railway routes	20 locations	Inverness to Wick
Agricultural land (km ²)	7	n/a

Table 1: Infrastructure and agricultural land at risk of coastal flooding

Designated environmental and cultural heritage sites at risk

Within the coastal area there are approximately 24 cultural heritage sites at risk of coastal flooding. These include scheduled monuments, gardens and designed landscapes and listed buildings.

Approximately 17km² of environmental 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 Dornoch Firth, Loch Fleet and Morrich More, and Kyle of Sutherland Marshes.

History of coastal flooding

There were a number of localised floods recorded around Wick during the 1960s and 1970s, when property and infrastructure were damaged. Wick, Golspie and other communities along the east coast were flooded December 2012.

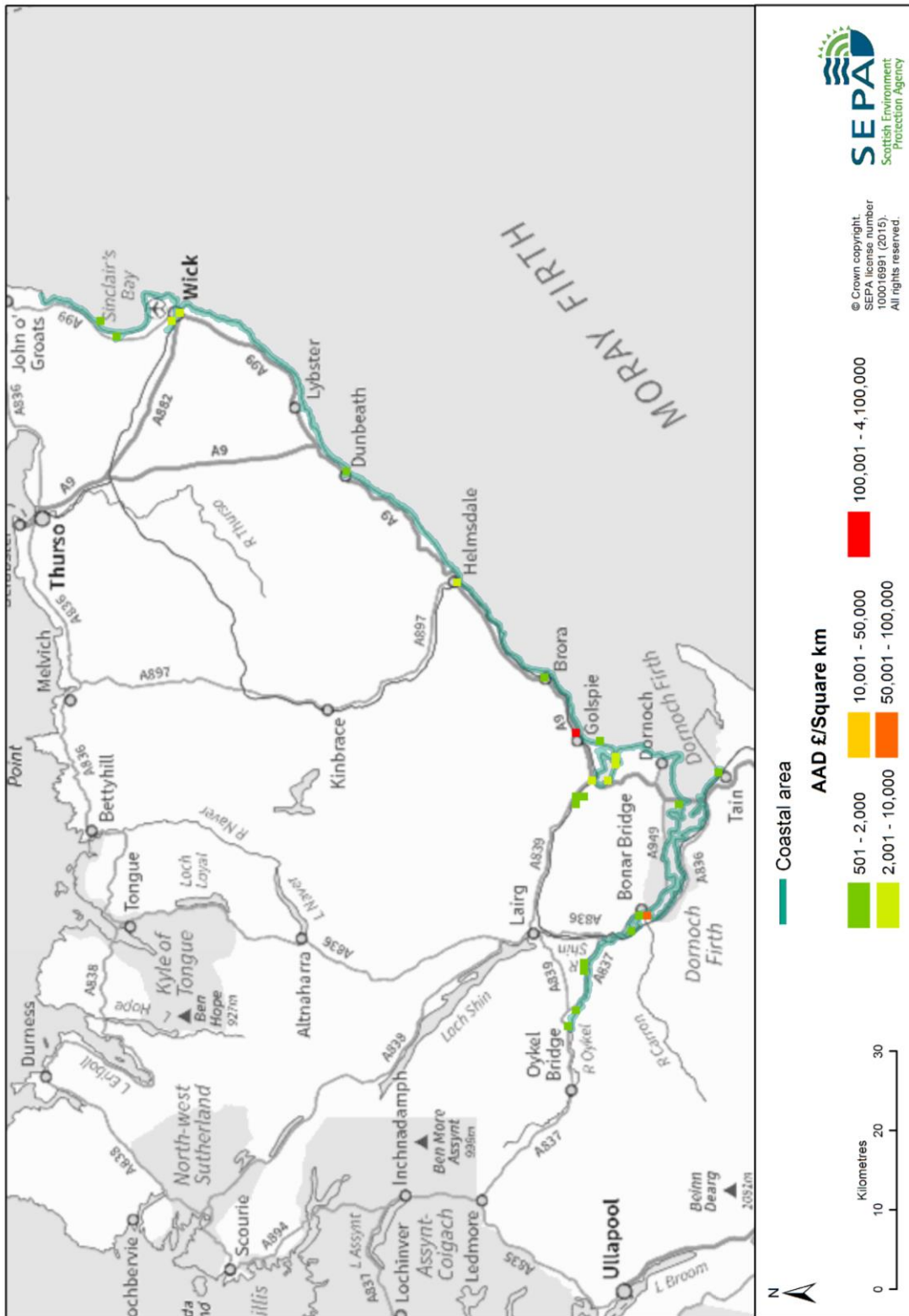


Figure 2: Annual Average Damages from coastal flooding

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.

Coastal flood warning schemes

The Nairn to Tarbat Ness coastal area benefits from the Moray Firth Coastal Flood Warning Scheme. There are three flood warning areas in the coastal area: 'Wick', 'Lybster to Dunbeath' and 'Helmsdale to Embo' (Figure 3).

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 Tarbat Ness to Duncansby Head coastal area is 0.5m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 20 to 40 and the number of non-residential from approximately 20 to 50. 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.

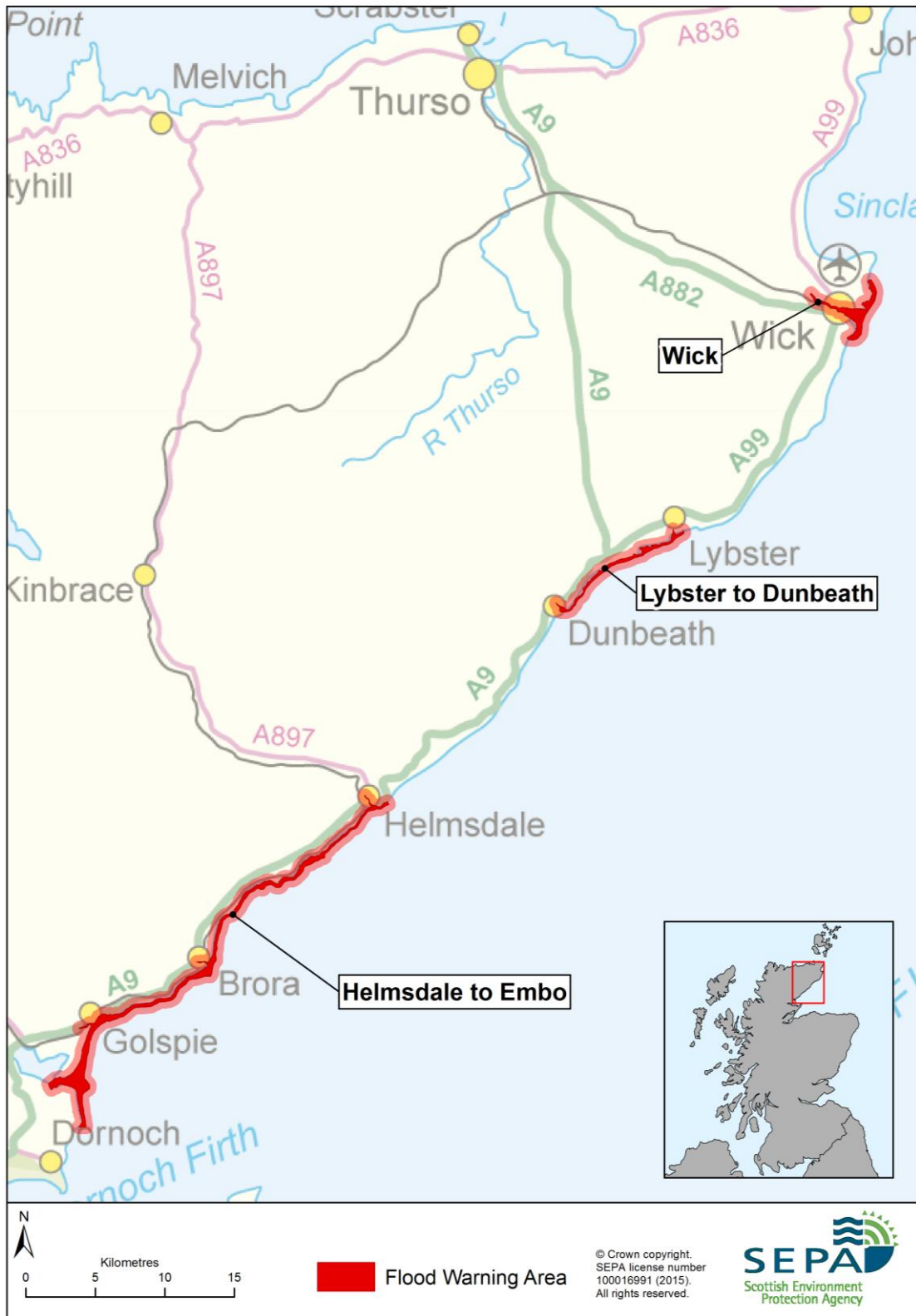


Figure 3: Flood warning areas

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.

Estuarine surge

There is limited opportunity for estuarine surge attenuation in the Tarbat Ness to Duncansby Head coastal area. There is only one area which has any potential, the Dornoch Firth where the majority of the potential is upstream of the Dornoch Firth Bridge, through the Kyle of Sutherland and up to the railway bridge between Culrain and Invershin.

Wave energy dissipation

The area around the Dornoch Firth has potential for wave energy dissipation, including the urban area of Tain. Elsewhere there are significant lengths of potential for dissipating wave energy such as at Golspie, Dornoch, Brora, Wick Bay, Sinclair's Bay and Freswick Bay.

Coastal flooding Duncansby Head to Cape Wrath

Coastal overview

The Duncansby Head to Cape Wrath coastal area has a length of approximately 250km and is located on the north coast between Duncansby Head (Freswick Bay) in the east and Cape Wrath in the west (Figure 1). The towns of Thurso, Scrabster and Durness, along with several smaller settlements are located along this coastline.

The coastline is rocky with a series of bays, including Balnakeil Bay, Tongue Bay and Dunnet Bay and the inlet of Loch Eriboll. There are occasional large sandy beaches for example at Dunnet Bay. The River Thurso, Halladale River and the River Naver outflow into the Atlantic Ocean. The coastal area contains just one Potentially Vulnerable Area which is Thurso (01/01).

Flood risk

Main areas at risk

There are fewer than 10 residential properties and fewer than 10 non-residential properties at a risk of coastal flooding. Approximately 50% of residential properties and 40% of non-residential properties are located within the Thurso Potentially Vulnerable Area (01/01).

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the Duncansby Head to Cape Wrath coastal area are estimated to be approximately £62,000. This accounts for less than 1% of the total damages for the Local Plan District. The damages are distributed as follows:

- 43% roads (£27,000)
- 34% residential properties (£21,000)
- 11% non-residential properties (£7,300)
- 5% agriculture (£3,100)
- 4% emergency services (£2,400)
- 3% vehicles (£1,500).

Figure 2 shows the Annual Average Damages throughout the coastal area.

Overall, there are around 2km² of agricultural land and 24 road locations at risk of coastal flooding.

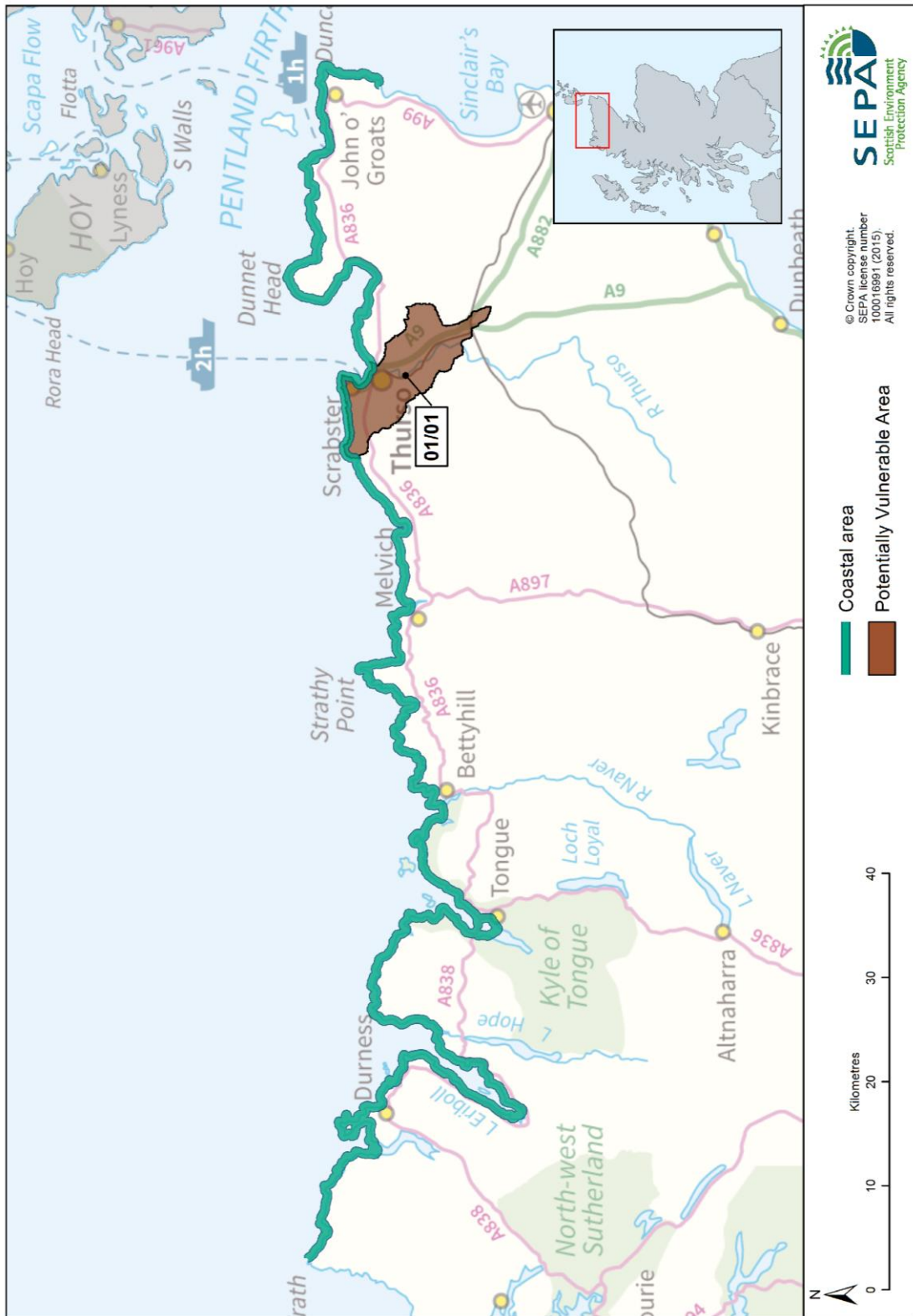


Figure 1: Duncansby Head to Cape Wrath coastal area and Potentially Vulnerable Areas

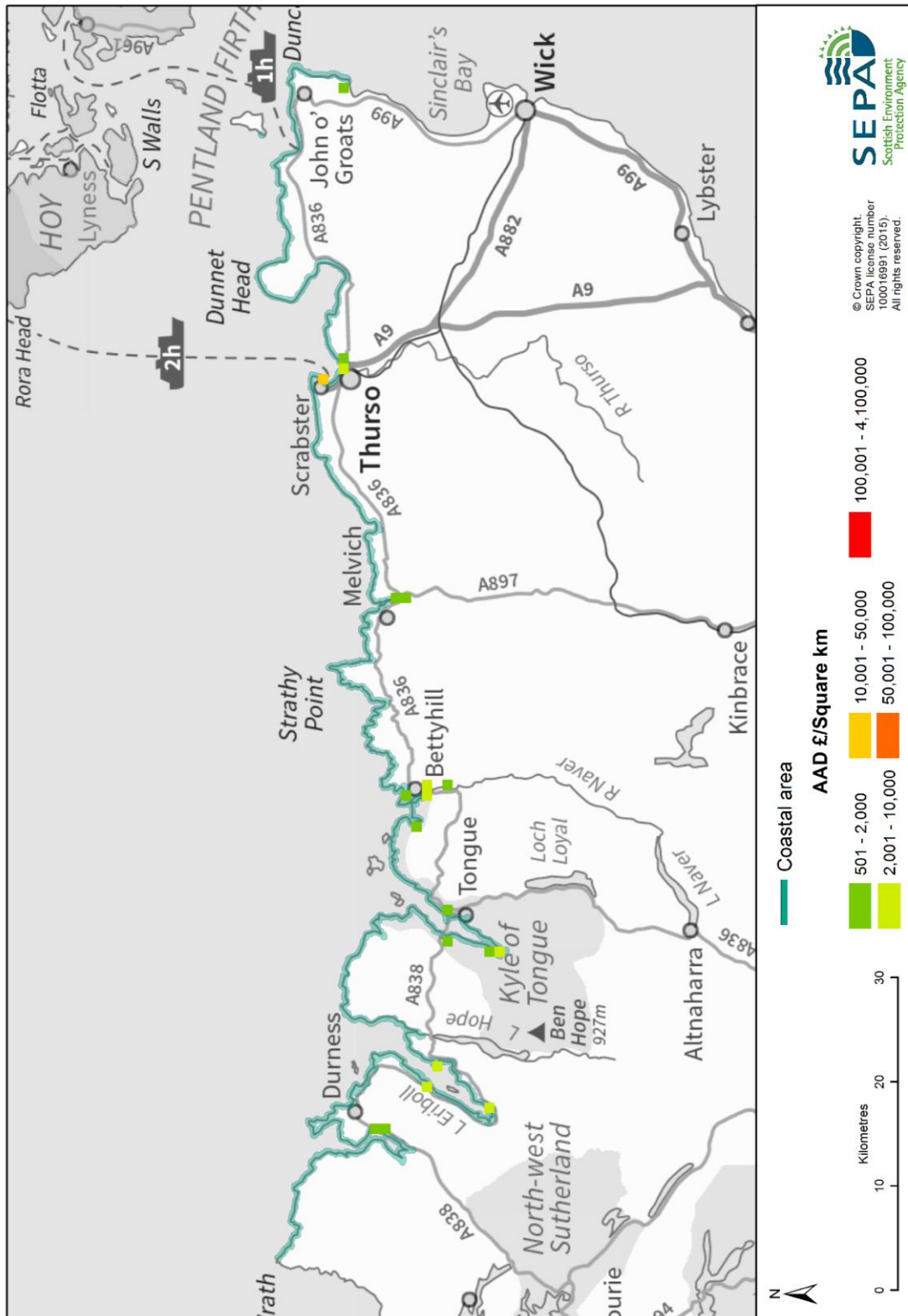


Figure 2: Annual Average Damages from coastal flooding

Designated environmental and cultural heritage sites at risk

There are ten cultural heritage sites at risk of coastal flooding in this coastal area. The sites include scheduled monuments, garden and designed landscapes and listed buildings.

Approximately 3km² of environmental 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 Cape Wrath, Strathy Coast, Invernaver, and Durness.

History of flooding

In 2005 coastal flooding affected a number of residential and non-residential properties and a road in Thurso. Flooding was potentially exacerbated due to the interaction of high tides and high river levels.

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 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 Duncansby Head to Cape Wrath coastal area is 0.5m by 2080. Under these conditions it is estimated that the number of residential and non-residential properties at risk of coastal flooding does not change significantly. 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 people 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.

Estuarine surge

The coastline between Duncansby Head and Cape Wrath has no potential for estuarine surge attenuation.

Wave energy dissipation

There is potential for wave energy dissipation along most of the coastline between Duncansby Head and Cape Wrath. The areas of potential wave energy dissipation tend to be within the bays such as Dunnet Bay, Thurso Bay, Sandside Bay, Melvich Bay, and the Kyle of Tongue. Thurso (01/01) has potential for wave energy dissipation along its Thurso Bay frontage, but limited potential along its other coastal boundaries.

Coastal flooding Cape Wrath to Ardnamurchan Point

Coastal overview

The Cape Wrath to Ardnamurchan coastal area has a length of approximately 1,500km extending from Cape Wrath at the north-west tip of mainland Scotland to Ardnamurchan Point on the western coast (Figure 1). It includes the islands of Skye, Rum, Eigg, Canna, and Muck. The coastline is heavily indented with numerous lochs and sounds and there are numerous towns and villages located close to the coastline such as Lochinver, Ullapool, Kyle of Lochalsh, Uig, and Mallaig. The coastal area contains five Potentially Vulnerable Areas:

- 01/05: Lochinver
- 01/11: Uig – Isle of Skye
- 01/12: Poolewe
- 01/22: Lochailort
- 01/26: Sunart and Moidart.

Flood risk

Main areas at risk

Within the Cape Wrath to Ardnamurchan Point coastal area, there are approximately 190 residential and 130 non-residential properties at risk of coastal flooding. Only around 5% of residential properties and 7% of non-residential properties at risk are located within Potentially Vulnerable Areas.

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the Cape Wrath to Ardnamurchan Point coastal area are estimated to be £2.3 million. This accounts for around 9% of the total damages for the Local Plan District. The damages are distributed as follows:

- 40% non-residential properties (£930,000)
- 26% residential properties (£610,000)
- 25% roads (£580,000)
- 7% emergency services (£150,000)
- 2% vehicles (£55,000)
- 1% agriculture (£18,000).

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

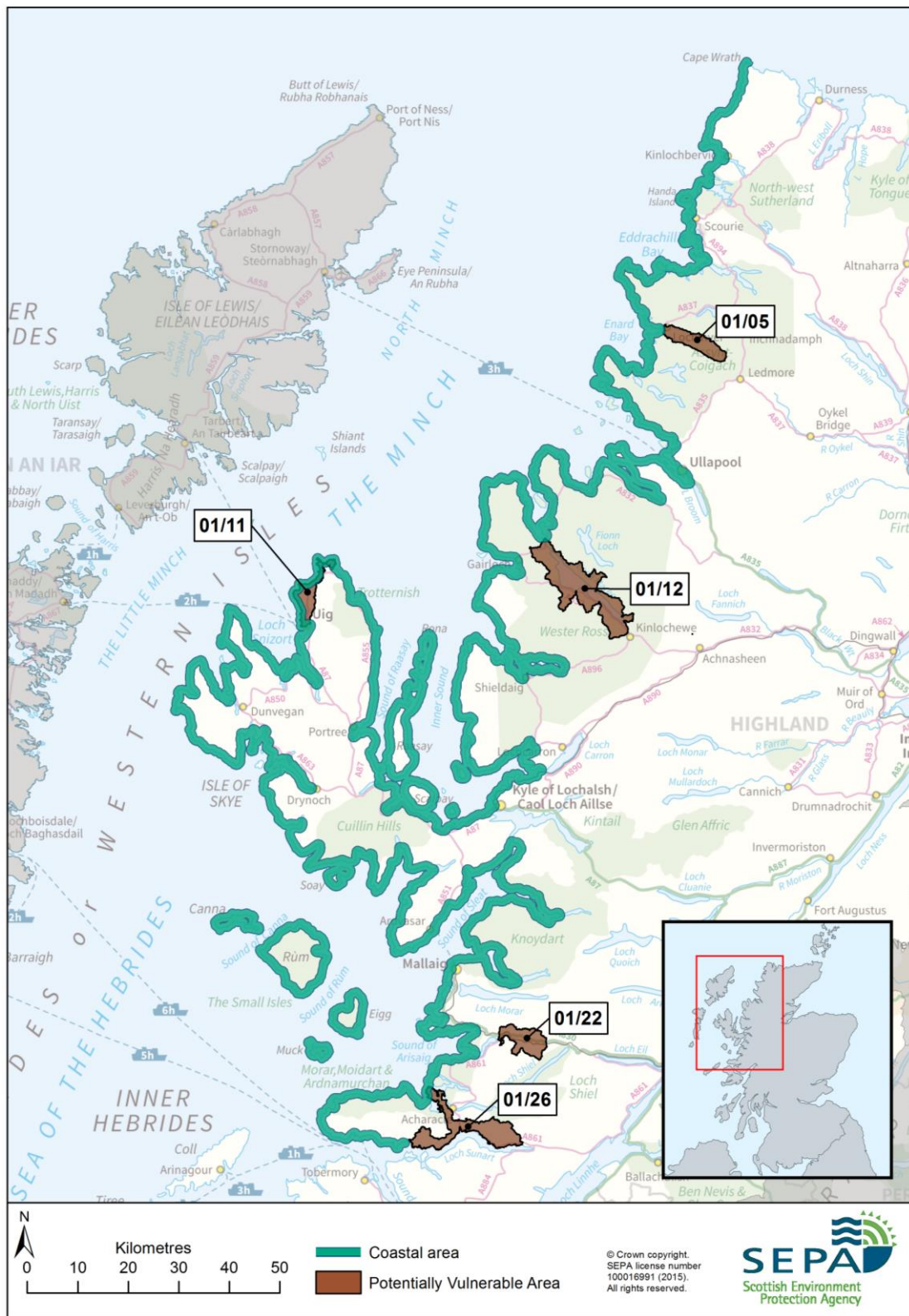


Figure 1: Cape Wrath to Ardnamurchan Point coastal area and Potentially Vulnerable Areas

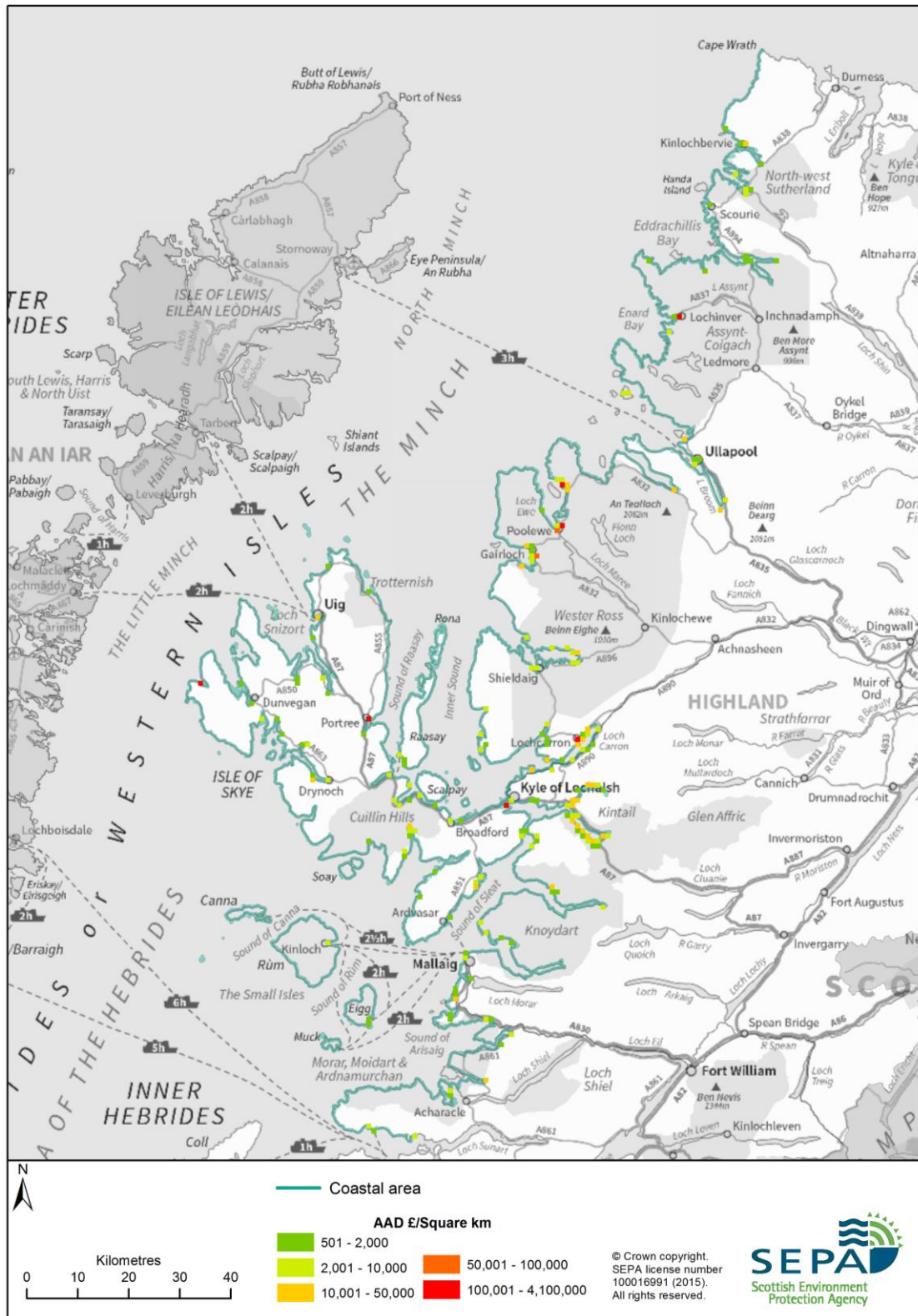


Figure 2: Annual Average Damages from coastal flooding

Table 1 shows further information about infrastructure and agricultural land at risk of coastal flooding.

	Number at risk	Further detail
Community facilities	0	n/a
Utility assets	<10	Electricity sub-stations
Roads (excluding minor roads)	320	Including A838 and A894
Railway routes	26 locations	Fort William to Mallaig
Agricultural land (km²)	12	n/a

Table 1: Infrastructure and agricultural land at risk of coastal flooding

Designated environmental and cultural heritage sites at risk

There are around 56 cultural heritage sites at risk of coastal flooding in this coastal area. The sites include castles and towers, ecclesiastical sites, and prehistoric domestic/defensive and ritual/funerary sites (such as brochs, duns, forts, and cairns), which are all Scheduled Monuments. There are also gardens and designed landscapes and listed buildings at risk.

Approximately 11km² 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). Some of the sites with the largest areas of flooding include Rum, Canna and Sanday, Sunart, and the Loch Moidart and Loch Shiel Woods.

History of coastal flooding

Coastal flooding occurred at Ullapool, Gairloch, Uig, and Mallaig in 2005. Flooding was also reported at Dalaccladdich in Lochcarron in 2006. Roads were affected but there are no details of how many properties were affected.

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 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 Cape Wrath to Ardnamurchan coastal area is 0.5m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 190 to 300 and the number of non-residential from approximately 130

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

There are no opportunities identified for estuarine surge attenuation in the Cape Wrath to Ardnamurchan Point coastal area.

Wave energy dissipation

The potential for wave energy dissipation along the majority of the coast in this coastal area tends to be scattered rather than continuous. There tends to be areas of continuous potential around the inner lochs including Upper Loch Torridon, Loch Gairloch, Loch Alsh, and Loch Hourn. Around the northern tip of the Isle of Skye there are continuous stretches of high potential in Staffin Bay and along the western coastline of Skye there are several stretches of potential for wave energy dissipation. The islands of the Inner Hebrides also have scattered potential for wave energy dissipation.

Coastal flooding Ardnamurchan Point to Mull Of Kintyre

Coastal overview

This Ardnamurchan Point to the Mull of Kintyre coastal area is located on the west coast and includes the Inner Hebrides (Mull, Coll, Tiree, Iona, Jura, Islay, Gigha, Colonsay, Scarba, Lunga and the Garvellachs). The coastal area is approximately 1,500km in length and is heavily indented with lochs and sounds, including Loch Linnhe, Figure 1.

There are numerous towns and smaller settlements located close to the coastline including Fort William, Ballachulish, and Oban. There are 13 Potentially Vulnerable Areas:

- 01/23: Corpach
- 01/24: Caol and Inverlochty
- 01/25: Fort William
- 01/26: Sunart and Moidart
- 01/27: South Ballchulish
- 01/28: Ballachulish and Glencoe
- 01/29: Isle of Mull – Craignure
- 01/30: Ross of Mull
- 01/31: Oban
- 01/32: Loch Feochan
- 01/33: Taynuilt
- 01/34: Loch Awe
- 01/35: Craignish.

Flood risk

Main areas at risk

Within the Ardnamurchan Point to Mull of Kintyre coastal area, there are approximately 470 residential and 310 non-residential properties at risk of coastal flooding. Approximately 75% of residential properties and 50% of non-residential properties at risk are located within Potentially Vulnerable Areas, with the majority of these in Caol and Inverlochty (01/24) and in Oban (01/31).

Table 1 is a summary of the main areas which have the most properties at risk of coastal flooding within the coastal area.

	Number of residential and non-residential properties at risk of coastal flooding	Annual Average Damages
Caol and Inverlochty	170	£240,000
Oban	240	£270,000
Fort William	80	£140,000
Ballachulish and Glencoe	40	£73,000

Table 1: Main areas at risk of coastal flooding

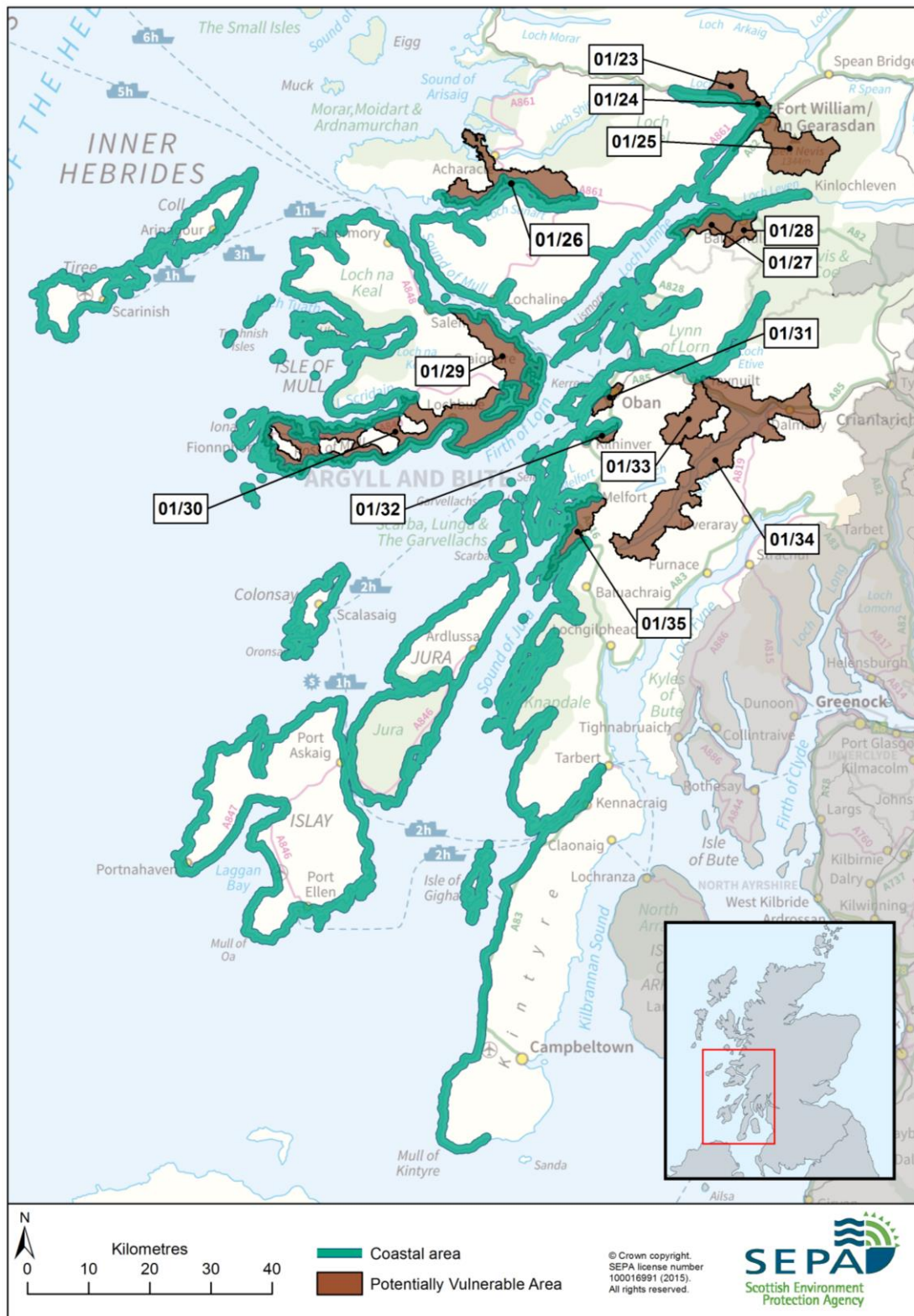


Figure 1: Ardnamurchan Point to Mull of Kintyre coastal area and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the Ardnamurchan Point to Mull of Kintyre coastal area are approximately £4.4million. This accounts for around 17% of the Annual Average Damages for the Local Plan District. The damages are distributed as follows:

- 52% non-residential properties (£2.3million)
- 27% roads (£1.2million)
- 12% residential properties (£550,000)
- 7% emergency services (£290,000)
- 1% agriculture (£36,000)
- 1% vehicles (£34,000).

Figure 2 shows the location of Annual Average Damages from coastal flooding across the area. The areas with greatest damages are Oban and Fort William.

Table 2 shows further information about infrastructure and agricultural land at risk of coastal flooding.

	Number at risk	Further detail
Community facilities	<10	Includes; educational buildings and emergency services.
Utility assets	10	Includes; electricity substations, telephone exchanges and mineral/fuel extraction sites.
Roads (excluding minor roads)	470	Notably; A83, A85, A816, A828, A861
Railway routes	19 locations	Crianlarich to Fort William, Crianlarich to Oban.
Agricultural land (km²)	24	n/a

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

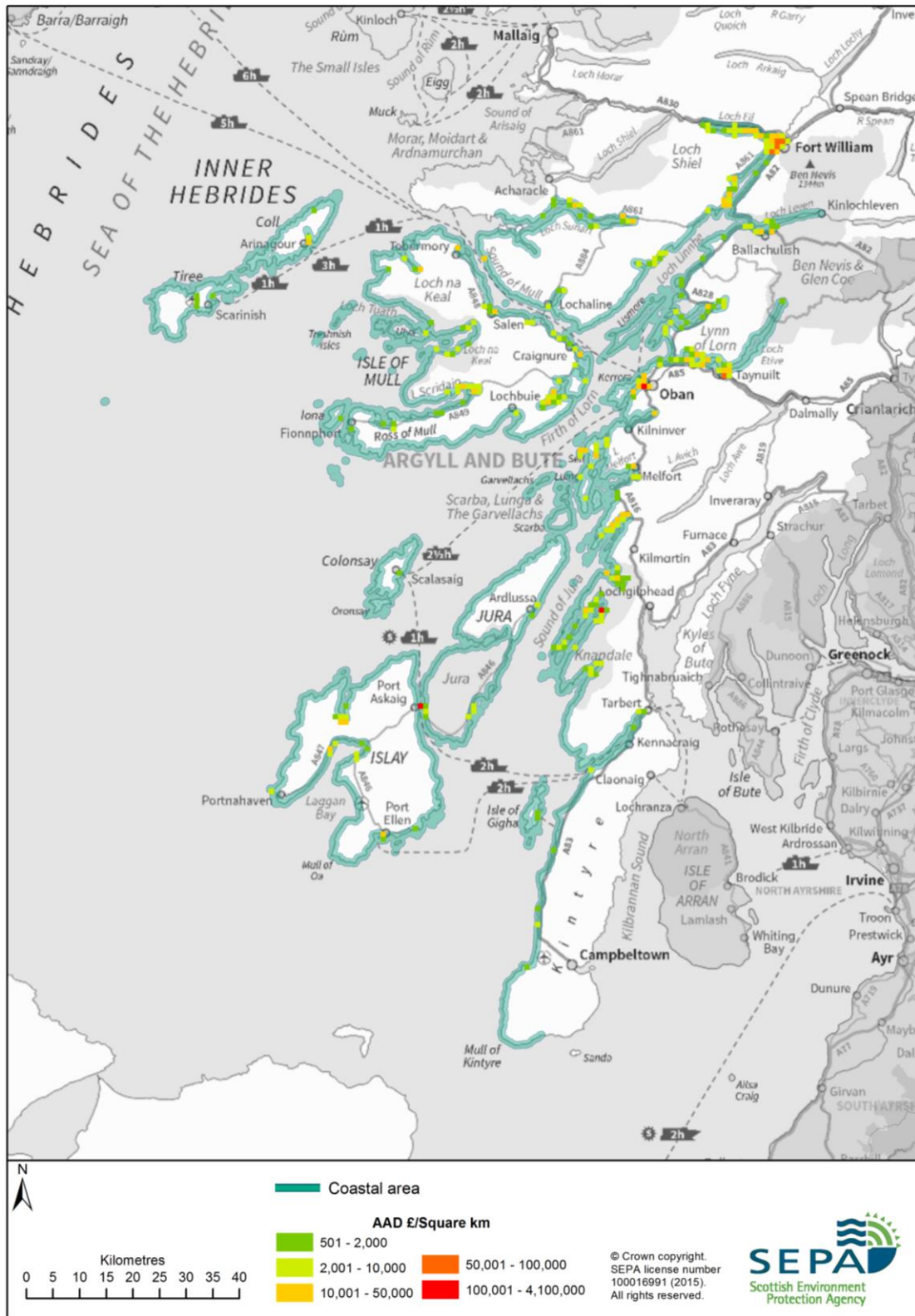


Figure 2: Annual Average Damages from coastal flooding

Designated environmental and cultural heritage sites at risk

There are around 80 cultural heritage sites at risk of coastal flooding. The sites include Scheduled Monuments, listed buildings and gardens and designed landscapes.

Approximately 40km² 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). Some of the sites with the largest areas of flooding include Gruinart Flats, Tiree Wetlands, Moine Mhor, Tiree Machair, and Tayvallich Juniper.

History of flooding

There have been a number of localised coastal floods. A storm surge in November 2005 on Loch Linnhe affected Caol and other communities as well as road infrastructure in northern and western Scotland. Tobermory sea front has been subject to a number of floods due to high water levels and wave action. Flooding of the main road and car park occurs and properties adjacent to the road are regularly threatened with inundation of seawater.

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.

Coastal flood warning schemes

The Ardnamurchan Point to the Mull of Kintyre coastal area benefits from the Firth of Lorn and Loch Linnhe Coastal Flood Warning Scheme. There are three coastal flood warning areas details of which are listed in Table 3 and their locations are shown in Figure 3.

Flood warning area (FWA)	Number of properties within FWA	% of properties registered January 2014
Corpach and Caol	690	16%
Fort William	136	11%
Oban	77	3%

Table 3: Flood warning areas

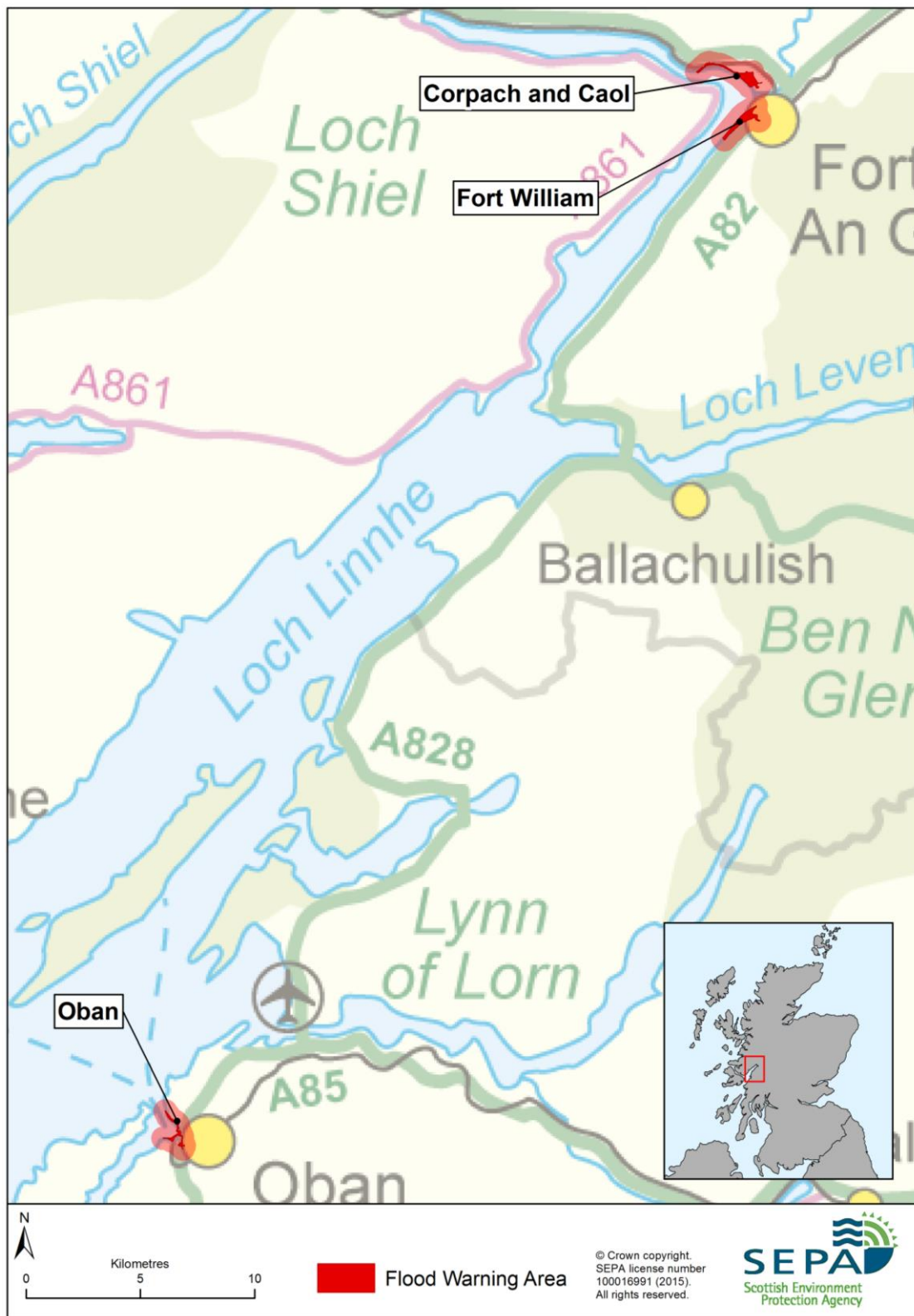


Figure 3: Flood warning areas

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 Ardnamurchan Point to Mull of Kintyre coastal area is 0.5m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 470 to 950 and the number of non-residential from approximately 310 to 630. 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

In the Ardnamurchan Point to Mull of Kintyre Coastal Area the only areas of potential for estuarine surge attenuation are along Loch Linnhe and Loch Etive in the north of the area. There is continuous potential along the majority of both shores of Loch Etive, from Connel to Gualachulain. On Loch Linnhe the areas of continuous potential extend from the Corran Narrows up into Loch Eil. Potentially Vulnerable Areas Corpach (01/23), Caol and Inverlochy (01/24), Fort William (01/25), and Taynuilt (01/33) all have potential for estuarine surge attenuation along their coastal boundaries.

Wave energy

There is scattered potential for wave energy dissipation along the majority of the coast in this catchment, although there are few continuous stretches of potential. The potential for wave energy dissipation tends to be located within open bays, with less potential located within the inner lochs, such as Loch Linnhe. The Kintyre Peninsula shows less potential for wave energy dissipation than the rest of the catchment, with the Isle of Mull having several continuous sections of potential along the west and south coasts.

Coastal flooding Mull of Kintyre to Kilbride Bay

Coastal overview

This Mull of Kintyre to Kilbride Bay coastal area includes approximately 510km of coastline extending from the Mull of Kintyre to Kilbride Bay in the Sound of Bute, (Figure 1). There are numerous towns and smaller settlements located close to the coastline including Campbeltown, Tarbert, Lochgilphead and Inveraray.

The coastline, which includes Loch Fyne, is heavily indented and the area is generally sheltered from the Atlantic swell and Irish Sea waves. Beaches are generally located on the eastern coastline of the Kintyre Peninsula and are in a relatively stable state. Along the edges of the sea lochs narrow shingle fringe beaches are common. There are four Potentially Vulnerable Areas:

- 01/37: Inveraray
- 01/38: Lochgilphead
- 01/39: Tarbert
- 01/40: Campbeltown.

Flood risk

Main areas at risk

There are approximately 200 residential and 310 non-residential properties at risk of coastal flooding in the Mull of Kintyre to Kilbride coastal area. Approximately 74% of residential properties and 76% of non-residential properties at risk are located within Potentially Vulnerable Areas, with the majority in Campbeltown and Inveraray.

Table 1 is a summary of the main areas which have the most properties at risk of coastal flooding within the coastal area.

	Number of residential and non-residential properties at risk of flooding	Annual Average Damages
Campbeltown	270	£75,000
Inveraray	90	£370,000

Table 1: Main areas at risk of coastal flooding

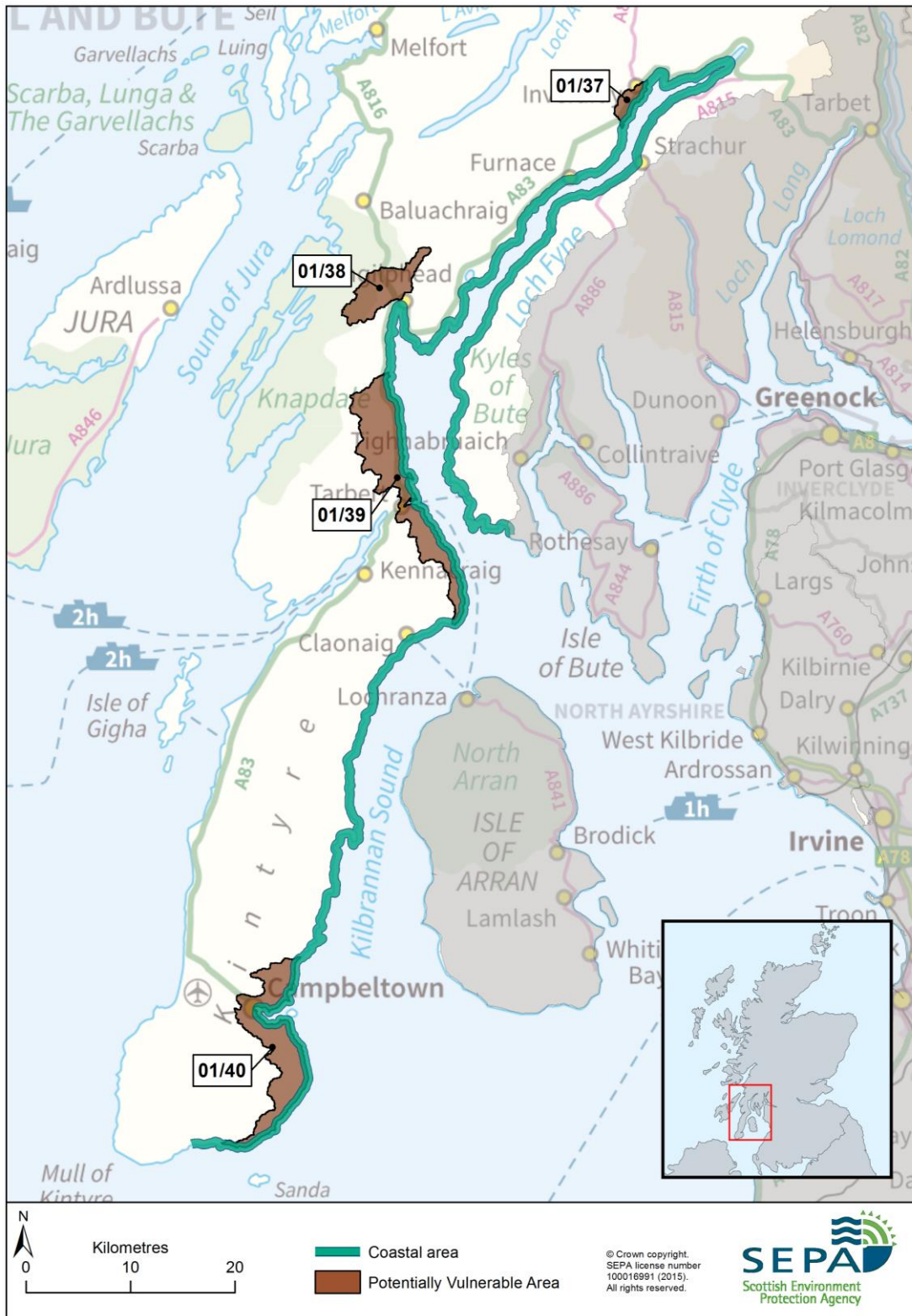


Figure 1: Mull of Kintyre to Kilbride Bay coastal area and Potentially Vulnerable Areas

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the Mull of Kintyre to Kilbride coastal area are approximately £900,000. This accounts for around 3% of the Annual Average Damages for the whole Local Plan District. The damages are distributed as follows:

- 32% non-residential properties (£280,000)
- 30% residential properties (£270,000)
- 29% roads (£260,000)
- 6% emergency services (£56,000)
- 3% vehicles (£25,000)
- <1% agriculture (£2,700).

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

Table 2 shows further information about infrastructure and agricultural land at risk of coastal flooding.

	Number at risk	Further detail
Community facilities	<10	Emergency services
Utility assets	<10	Electricity substations
Roads (excluding minor roads)	130	Notably; A83
Railway routes	0	n/a
Agricultural land (km ²)	2	n/a

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

Designated environmental and cultural heritage sites at risk

There are approximately 37 cultural heritage sites at risk of coastal flooding in this coastal area. The sites include bridges, castles, and prehistoric domestic/defensive and ritual/funerary sites (such as duns, forts, and cairns), which are all scheduled monuments. There are also gardens and designed landscapes and listed buildings at risk.

Less than 1km² of environmental designated area is at risk of coastal flooding including Special Areas of Conservation (SAC) and Sites of Special Scientific Interest (SSSI). The sites affected include Tarbert Woods, Claonaig Wood, Balnabraid Glen, Strone Point, and Artilligan and Abhainn Strathain Burns.

History of flooding

There have been a number of localised coastal floods, including in 2010 on Loch Fyne.

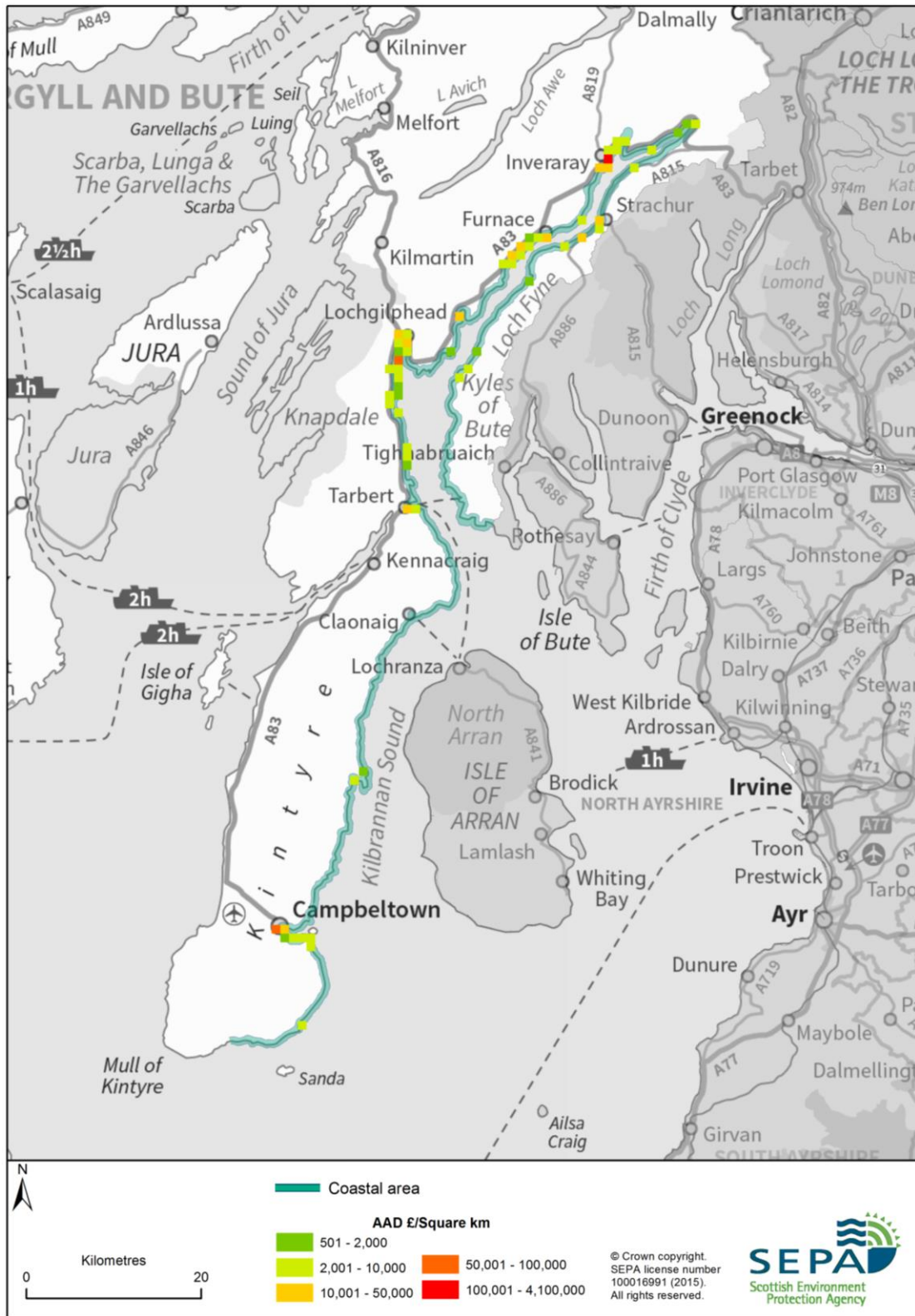


Figure 2: Annual Average Damages from coastal flooding

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.

Coastal flood warning schemes

The Mull of Kintyre to Kilbride Bay coastal area benefits from the Firth of Lorn and Loch Linnhe Coastal Flood Warning Scheme. There are four coastal flood warning areas, which are shown in Figure 3. The flood warning areas cover parts of Campbeltown, Lochgilphead, Lochgair and Tarbert and are listed in Table 3.

Flood warning area (FWA)	Number of properties within FWA	% of properties registered January 2014
Campbeltown Hall Street and Esplanade	756	10%
Lochgair Village Road	4	50%
Lochgilphead A83	34	21%
Tarbert Harbour	53	23%

Table 3: Flood warning areas



Figure 3: Flood warning areas

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 Mull of Kintyre to Kilbride Bay coastal area is 0.5m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 200 to 490 and the number of non-residential from approximately 310 to 600. 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

There are no opportunities for estuarine surge attenuation in the Mull of Kintyre to Kilbride Bay coastal area.

Wave energy

There is scattered potential for wave energy dissipation along the majority of the coast in this area although there are a few continuous stretches of potential. The areas with potential include the coastline of the Campbeltown Potentially Vulnerable Area (01/40) and the inner section of Loch Fyne to the north of Lochgilphead.

3.4 Surface water flooding

Highland and Argyll 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 Highland and Argyll Local Plan District there are approximately 1,100 residential properties and 1,000 non-residential properties at risk of surface water flooding. Of the residential properties at risk, 68% are located within Potentially Vulnerable Areas with around 40% of those located in Inverness and the Great Glen (01/21).

Main areas at risk

The areas which have greater than 50 residential properties at risk of surface water flooding are shown in Table 1. The main areas at risk are around Inverness and in Dingwall. Table 1 also shows the estimated economic impact of surface water flooding in each area expressed as Annual Average Damages.

	Residential and non-residential properties at risk of surface water flooding	Annual Average Damages
Inverness	550	£470,000
Dingwall	120	£190,000
Fort William	80	£320,000
Oban	80	£140,000
Strathpeffer	20	£21,000

Table 1: Main areas at risk of surface water flooding

Economic activity and infrastructure at risk

The Annual Average Damages in the Highland and Argyll Local Plan District from surface water flooding are estimated to be £2.9 million. This accounts for 11% of the total flood damages for the Local Plan District. The damages are distributed as follows:

- 52% non-residential properties (£1.5 million)
- 38% residential properties (£1.1 million)
- 5% roads (£140,000)
- 4% emergency services (£130,000)
- 1% vehicles (£17,000).

Figures 1a and 1b show the location of Annual Average Damages from surface water flooding across the Local Plan District. The most significant contributing areas to the Annual Average Damages are Inverness, Dingwall, Fort William and Oban.

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

	Number at risk	Further detail
Community facilities	10	Includes: educational buildings, healthcare facilities and emergency services.
Utility assets	170	Includes: electricity substations, fuel extraction sites and telephone exchanges.
Roads (excluding minor roads)	3,800 locations	Notably parts of the A9
Railway routes	560 locations	Inverness to Aberdeen, Inverness to Wick, Crianlarich to Fort William, Crianlarich to Oban.
Airports	2	Inverness airport, Wick airport.

Table 2: Infrastructure at risk of surface water flooding

Designated environmental and cultural heritage sites at risk

There are approximately 50 cultural heritage sites at risk of surface water flooding. Sites at risk include battlefields, gardens and designed landscapes, scheduled monuments (chapels, castles, forts, mottes, bridges, settlements, and prehistoric domestic/defensive and ritual/funerary sites) and listed buildings.

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

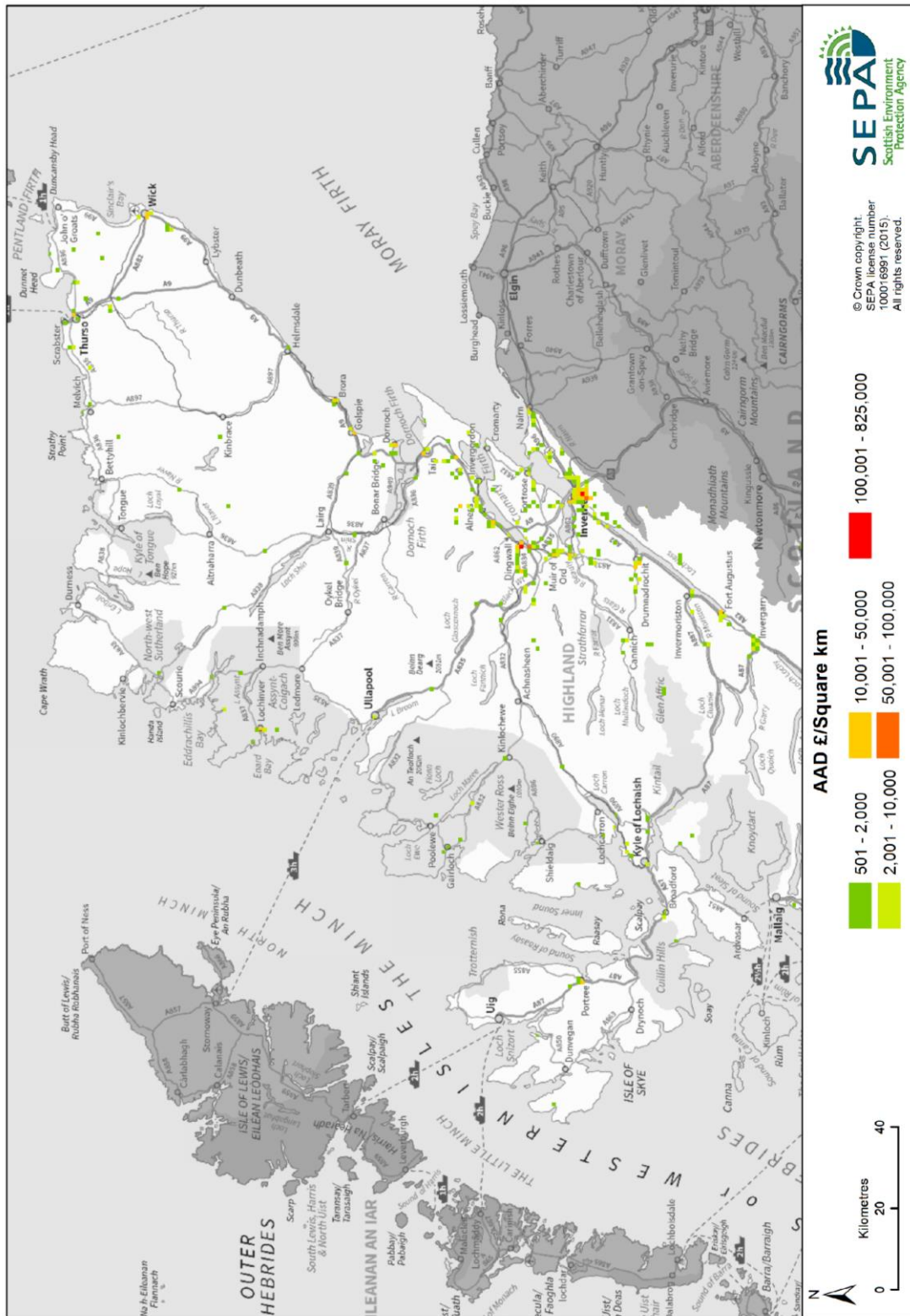


Figure 1a: Annual Average Damages from surface water flooding

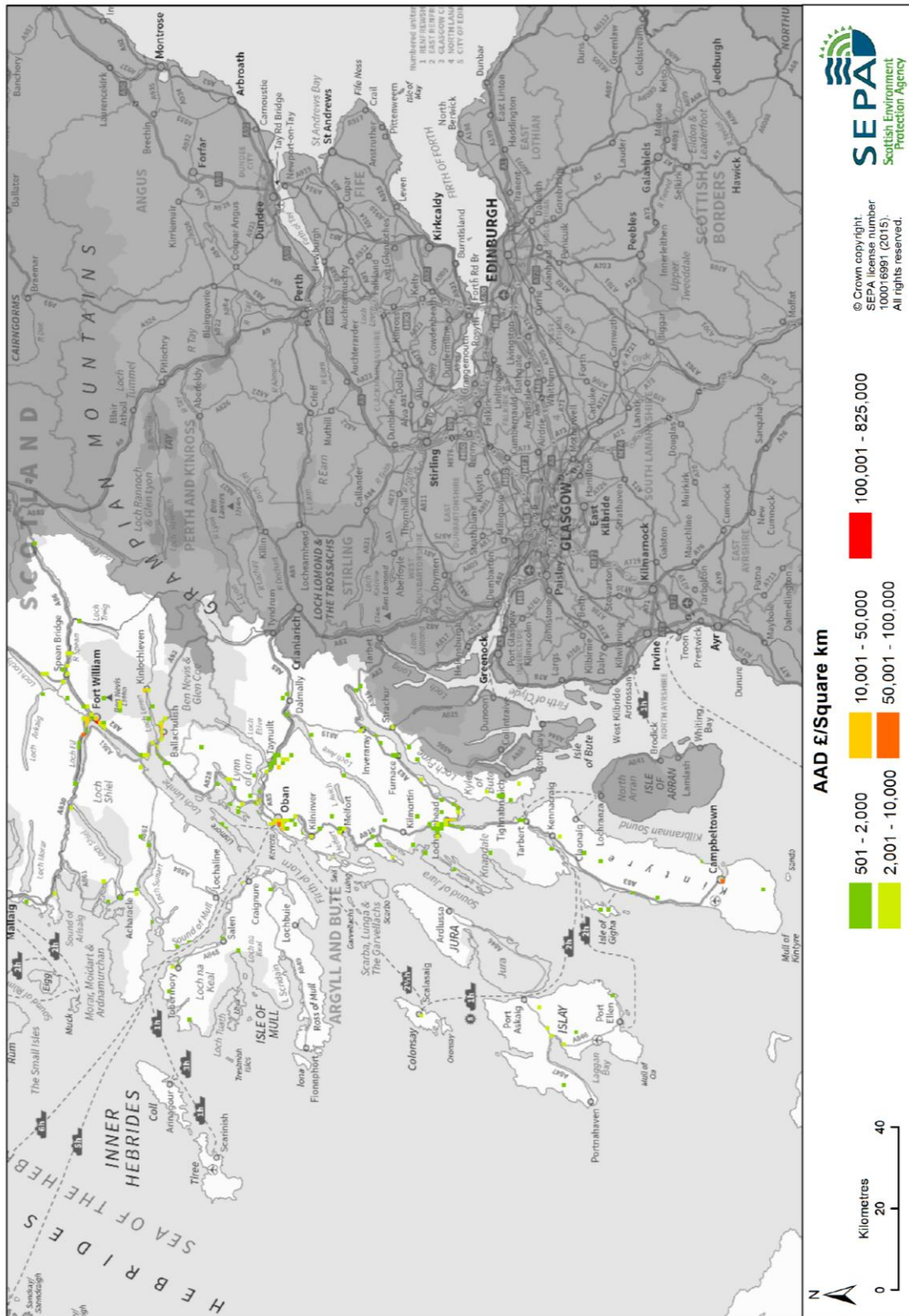


Figure 1b: Annual Average Damages from surface water flooding

History of flooding

In 1916 flooding damaged roads and sections of a railway line and in 1956 sections of the Inverness to Elgin railway line were washed away.

There have been a number of localised floods, which can be attributed to surface water flooding. Smithton and Culloden suffered flooding in 2001. Inverness, including Millburn and the Inshes Retail Park, and Smithton and Culloden flooded in 2002. In 2005 there was surface water flooding in Oban. Smithton and Culloden and rural parts of Nairnshire were affected by surface water flooding in 2011. Fort William has also been affected by surface water flooding in the past.

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 area are described in Section 2.

Surface water management priority areas

The areas at highest risk from surface water flooding 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. These priority areas require surface water management plans to be prepared, the details of which can be found within the Potentially Vulnerable Area chapters in Section 2.

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 may increase from approximately 1,100 to 1,400 and the number of non-residential properties from approximately 1,000 to 1,200.

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.