

Flood Risk Management Strategy

Findhorn, Nairn and Speyside 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 Findhorn, Nairn and Speyside Local Plan District, river flooding is reported across two distinct river catchments. Coastal flooding and surface water flooding are reported across the whole Local Plan District.

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

	Total number of properties at risk ¹	Annual Average Damages	Local authority
River catchments			
Spey catchment group	700	£1.8 million	The Highland Council The Moray Council
Findhorn catchment group	560	£2.4 million	The Highland Council The Moray Council
Coastal flooding			
Portgordon to Nairn coastal area	160	£430,000	The Highland Council The Moray Council
Surface water flooding			
Findhorn, Nairn, and Speyside Local Plan District	1,100	£1.2 million	The Highland Council The Moray Council

Table 1: Summary of flood risk from various sources within the Findhorn, Nairn and Speyside Local Plan District

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

3.2 River flooding

Findhorn, Nairn and Speyside 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 Findhorn, Nairn and Speyside Local Plan District, river flooding is reported across two distinct river catchments (Figure 1):

- Spey catchment group
- Findhorn catchment group.

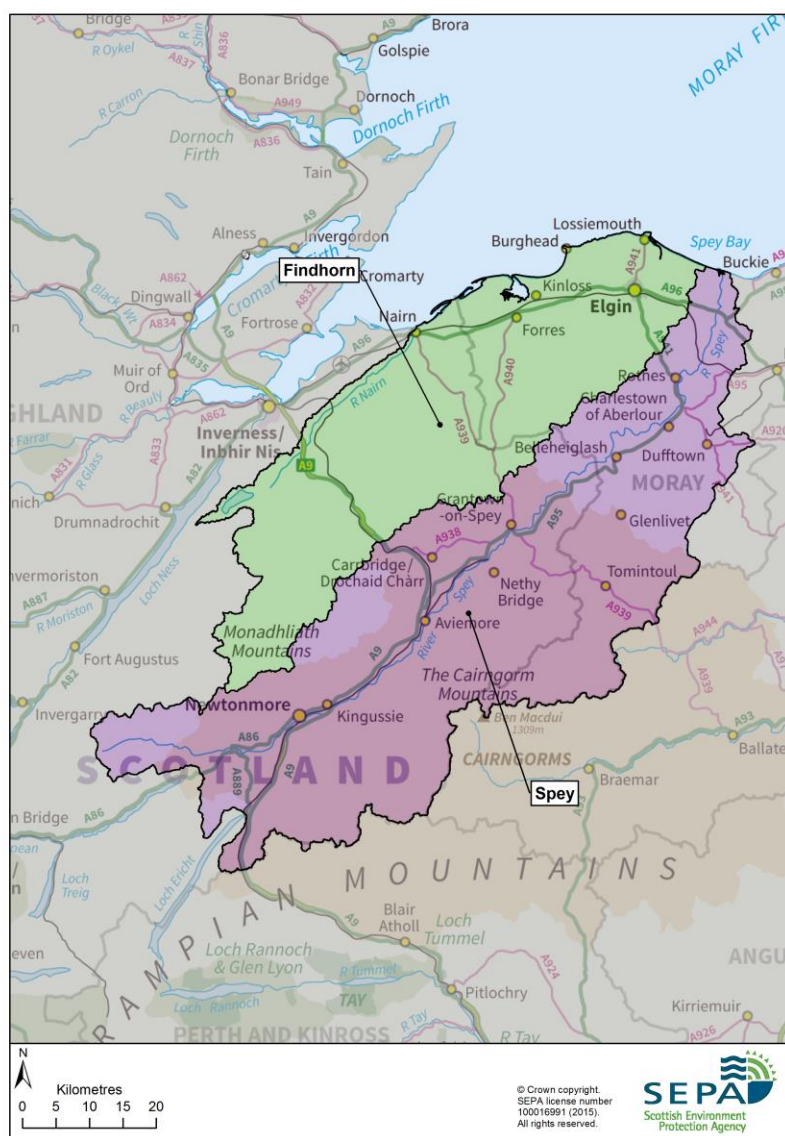


Figure 1: River catchments within the Findhorn, Nairn and Speyside Local Plan District

River flooding

Spey catchment group

Catchment overview

The Spey river catchment area (Figure 1) covers the southern and eastern area of the Findhorn, Nairn and Speyside Local Plan District and has an area of approximately 3,000km². The River Spey itself flows north east to the Moray Firth and has a number of significant tributaries that drain the surrounding area. These include the Burn of Rothes, which flows through Rothes; the River Fiddich through Dufftown; the River Livet and River Avon near Drumin, and the River Dulnain through Carrbridge.

The predominant land cover in the catchment is montane habitats, which cover 23% of the total area, mainly in the south. Acid grassland, coniferous woodland, heather and heather grassland each cover between 10-15% of the area. The area along the coast has an annual rainfall of between 600-900mm, with the inland areas receiving between 900-1,200mm per annum.

The catchment includes seven Potentially Vulnerable Areas:

- Spey Bay (05/04)
- Rothes and Aberlour (05/09)
- Carrbridge (05/10)
- Aviemore and Boat of Garten (05/11)
- Kingussie (05/12)
- Newtonmore (05/13)
- Dalwhinnie (05/14).

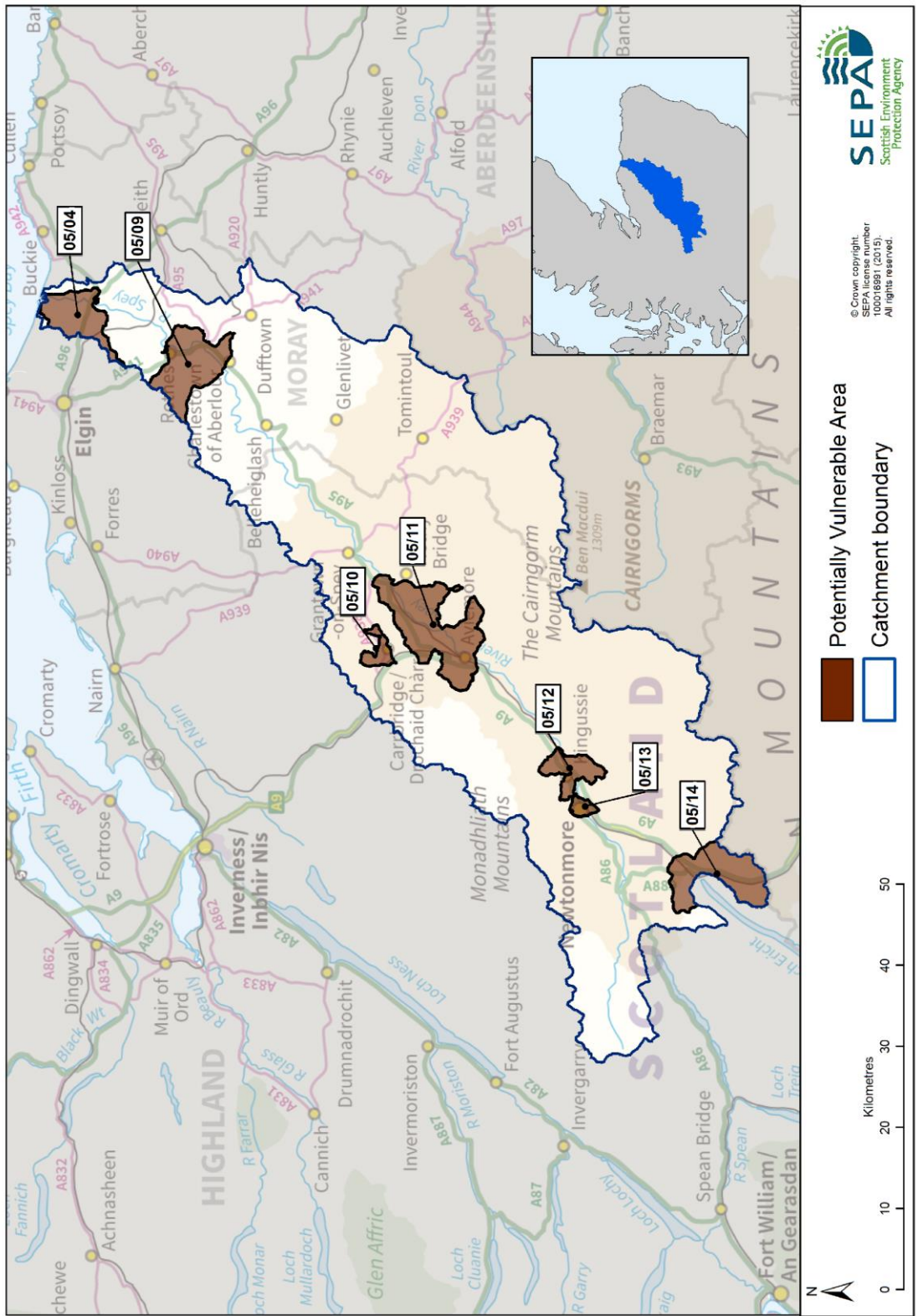


Figure 1: Spey river catchments area and Potentially Vulnerable Areas

Flood risk in the catchment

There are approximately 540 residential properties and 160 non-residential properties at risk of river flooding in the Spey river catchment area. Approximately 71% of residential and 65% of non-residential properties are located within the seven Potentially Vulnerable Areas.

Main areas at risk

The main areas that 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
Rothes	340	£180,000
Kingussie	60	£80,000
Dalwhinnie	30	£160,000
Spey Bay	20	£35,000

Table 1: Main areas at risk of river flooding

Rothes benefits from a flood protection scheme, which was designed to provide protection against flooding up to a 1 in 100 year event with an additional allowance for climate change. The assessment of the number of properties at risk in Rothes in table 1 is based on the 1 in 200 year event and does not take account of the residual protection provided by the flood protection scheme. The actual number of properties at risk therefore will be significantly less than reported in table 1. Annual Average Damage in Rothes will also be overestimated as a result.

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding are estimated to be £1.8 million. This accounts for around 31% of the Annual Average Damages for the Findhorn, Nairn and Speyside Local Plan District. The damages are distributed as follows:

- 41% residential properties (£730,000)
- 34% non-residential properties (£610,000)
- 10% agricultural land (£180,000)
- 7% emergency services (£130,000)
- 6% roads (£99,000)
- 2% vehicles (£32,000).

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

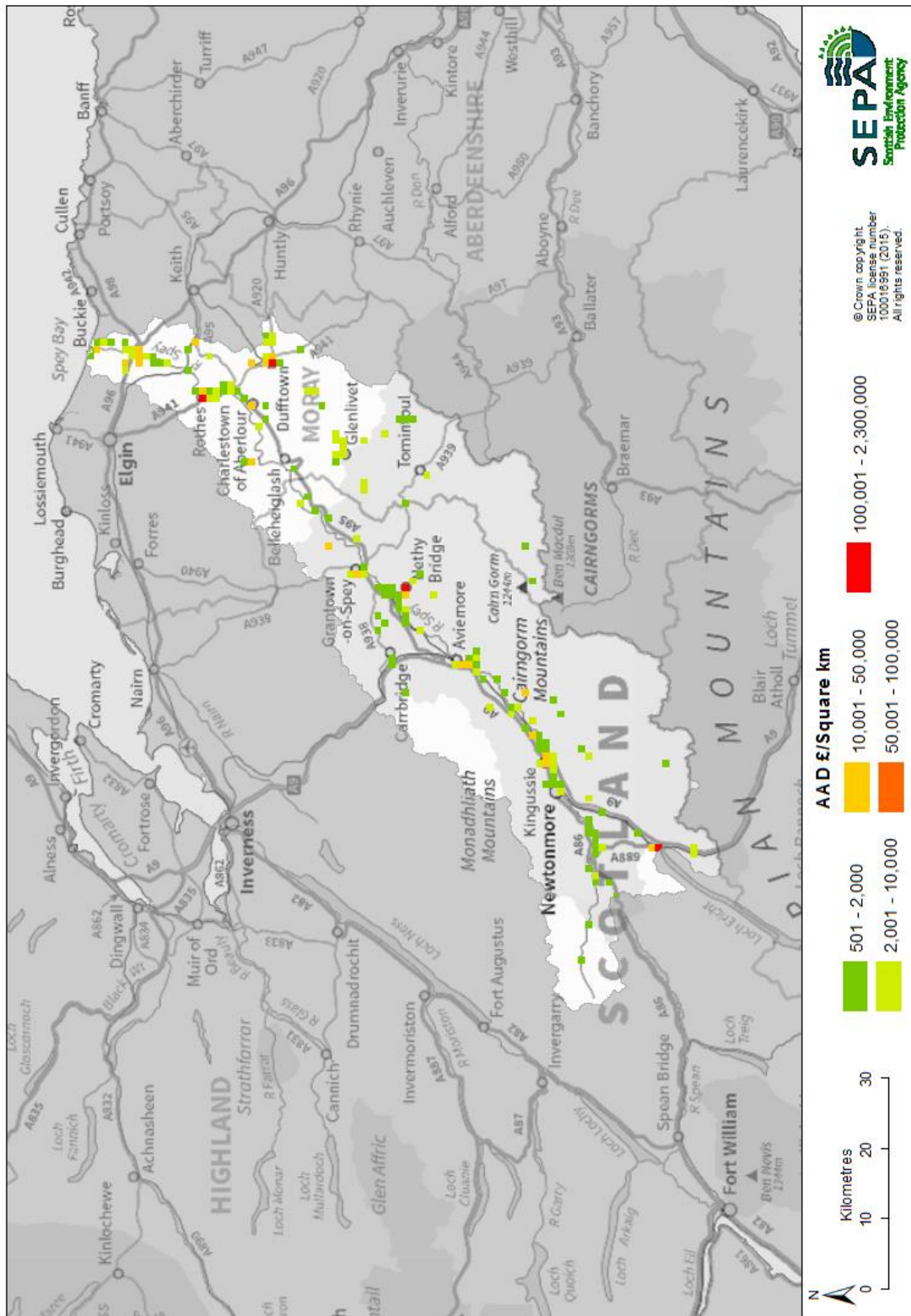


Figure 2: Annual Average Damages from river flooding

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	Emergency services
Utility assets	20	Includes; electricity substations, oil/gas extraction sites and telephone exchanges.
Roads (excluding minor roads)	370 locations	Notably the A9 and A95
Railway routes	60 locations	Aberdeen to Inverness
Agricultural land (km²)	21	n/a

Table 2: Infrastructure at risk of river flooding

Designated environmental and cultural heritage sites at risk

Within the catchment there are approximately 40 designated cultural heritage sites with a risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefields and listed buildings.

Approximately 176km² of designated environmental area is at risk of river flooding including Special Areas of Conservation, Special Protection Areas, and Sites of Special Scientific Interest. The designated sites which have the largest areas at risk include the Insh Marshes, the Cairngorms, Alvie, and Kinveachy Forest. However, many sites such as Insh Marshes benefit from or are resilient to flooding.

History of river flooding

The River Spey catchment area experienced considerable flooding during the 1829 Great Muckle Spate, when several bridges were destroyed. There have been many floods recorded from the River Spey, Gynack Burn, Burn of Rothes and River Dulnain.

The Spey has flooded Garmouth regularly, including in 1892, 1928, 1985, 1997, 2002 and 2009. A spate on the River Spey in the early 1960s led to two buildings being washed away in Kingston. The Spey has also flooded roads and properties in Newtonmore, Aviemore and Carrbridge on a number of occasions. Flooding occurs in Kingussie from the Gynach Burn, with the most recent occurrence in August 2014.

There is a long history of flooding in Rothes from smaller watercourses, such as the Burn of Rothes, Back Burn and Black Burn. The earliest recorded flood was in 1846, when heavy rainfall damaged crops in Knockando and Rothes. Notable floods occurred more recently in 2002, 2004, 2005, 2007, and 2009.

Large parts of north east Scotland were affected by flooding in August 2014 due to storms caused by hurricane Bertha. The railway line in Kingussie was flooded and the A938 road near Carrbridge was undermined.

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 11 flood warning areas for river flooding in the Spey river catchment, listed below in Table 3. These are the areas where SEPA has detailed models to predict flooding on specific rivers. The locations of the flood warning areas are shown in Figure 3.

Flood warning area	Residential properties within flood warning areas	% of properties registered (January 2014)
Aberlour, Craigellachie and Dandaleith	22	23%
Aviemore/Dalfaber	39	100%
Aviemore/Dalfaber to Grantown	49	24%
Boat O'Brig to Spey Viaduct	101	19%
Grantown to Aberlour	27	33%
Kincraig to Inverdrue	6	100%
Kingussie to Kincraig	12	42%
Newtonmore to Kingussie	67	22%
Roths (River Spey)	122	37%
Sluggan to Dulnain Bridge	5	40%
Spey Dam to Newtonmore	3	33%

Table 3: Flood warning areas

Awareness raising campaigns and community groups

There are a number of different action groups in this area including the Innes Community Council and flood action group in Kingston.

Other Actions

The Spey Catchment Initiative carried out natural flood management / river restoration works on a tributary upstream of the River Dulnain.

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 Spey catchment may increase by 24%. This would potentially increase in the number of residential properties at risk of river flooding from approximately 540 to 670, and the number of non-residential properties from approximately 160 to 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.

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 with the potential to manage flooding by reducing runoff within the Spey river catchment. However, most of the Potentially Vulnerable Areas do not have any significant areas of potential for runoff reduction either within or immediately adjacent to them. It is therefore unlikely that actions taken to reduce rainfall runoff will have a significant impact on flood risk within these Potentially Vulnerable Areas. An exception is Dalwhinnie (05/14) where there are significant areas of potential within the Potentially Vulnerable Area. However there is a need to improve understanding of flood mechanisms and risk levels in this area prior to progressing with any runoff reduction actions.

Floodplain storage

There are significant areas of potential for floodplain storage within the Spey catchment, along the entire length of the River Spey, and in more scattered small areas in the upland areas either side of the Spey valley. All of the Potentially Vulnerable Areas show significant potential for floodplain storage, particularly those directly along the River Spey. It is likely that floodplain storage could improve flood risk in the Potentially Vulnerable Areas and should be considered further. Dalwhinnie (05/14) however, only shows limited scattered patches of areas with potential for floodplain storage and therefore it is unlikely that there would be a significant impact on flood risk.

Sediment management

Although a lot of the river systems have substantial reaches that are in approximate sediment balance, there are also significant lengths of river which are predominantly eroding or depositing. The Potentially Vulnerable Areas which show the largest amount of erosion or deposition are Spey Bay (05/04), Rothes and Aberlour (05/09), Carrbridge (05/10), Aviemore and Boat of Garten (05/11), and Newtonmore (05/13). Actions to manage sediment in these Potentially Vulnerable Areas could potentially reduce flood risk.

River flooding Findhorn catchment group

Catchment overview

The Findhorn river catchment group covers the northern and western area of the Findhorn, Nairn and Speyside Local Plan District. It consists of three separate river catchments, the River Findhorn, the River Nairn and the River Lossie. The River Findhorn and River Nairn are the largest rivers in the west of the catchment and flow north east to the Moray Firth. These rivers and their numerous tributaries drain the higher ground in the south of the area. The River Lossie is the largest river in the east of the area. It flows south to north discharging into the Moray Firth.

The predominant land cover is coniferous woodland, which covers 21% of the total area; this is mainly located in the north and west of the catchment area. Improved grassland, heather grassland and bog each cover approximately 12% of the catchment. The area along the coast has an annual rainfall of between 400-900mm with inland areas receiving between 1,200-1,500mm per annum.

The catchment includes seven Potential Vulnerable Areas, which are located near to the coast towards the downstream ends of the major river systems (Figure 1):

- Burghead to Lossiemouth (05/01)
- Spynie (05/02)
- Lhanbryde (05/03)
- Elgin (05/05)
- Forres (05/06)
- River Findhorn (05/07)
- Nairn East and Auldearn (05/08).

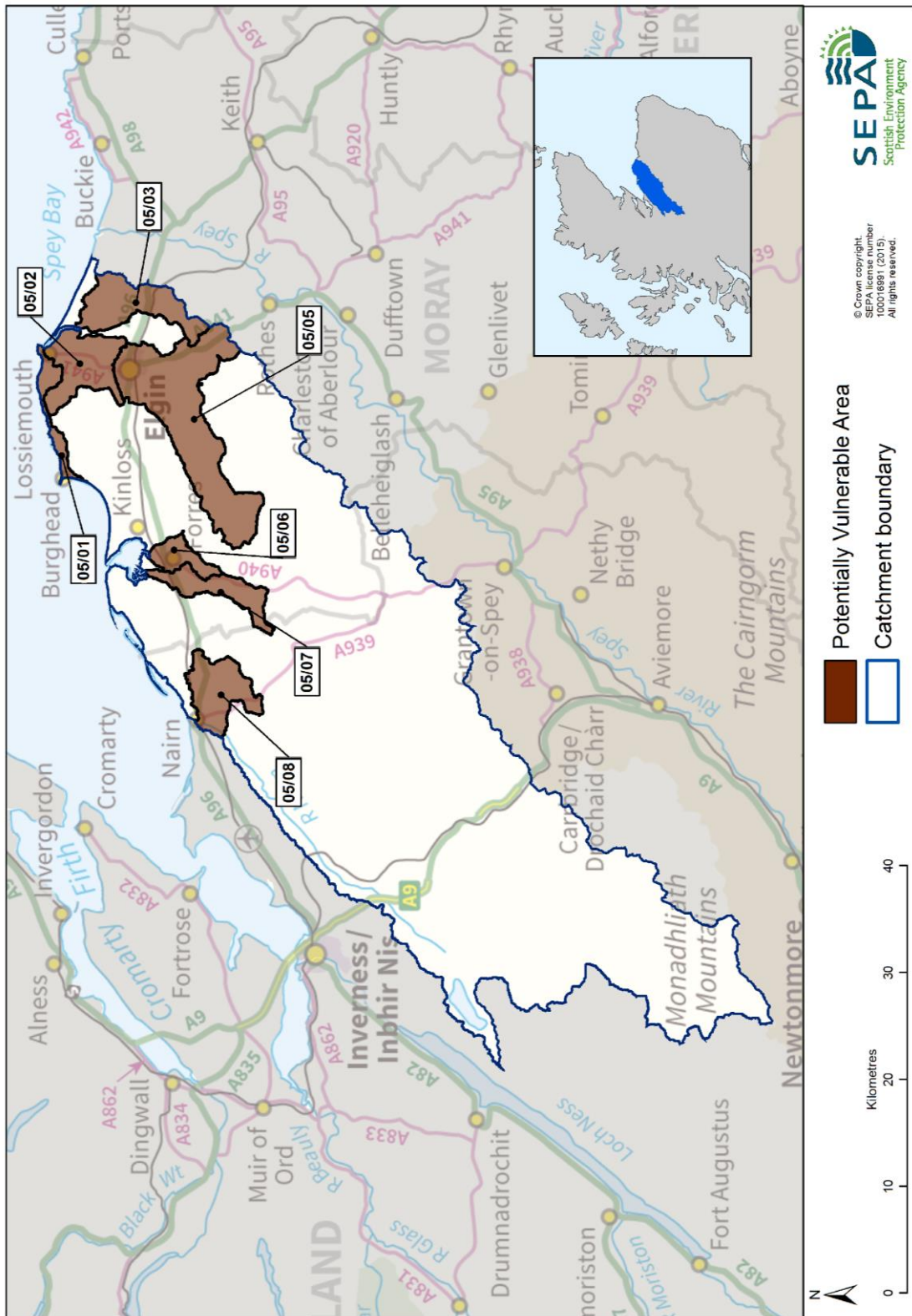


Figure 1: Findhorn river catchment group and Potentially Vulnerable Areas

Flood risk in the catchment

There are 460 residential properties and 100 non-residential properties are at risk of river flooding. Approximately 29% of residential and 46% of non-residential properties at risk are within the seven Potentially Vulnerable Areas.

Main areas at risk

The main areas that have more 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
Nairn ¹	310	£310,000
Kinloss	100	£320,000
Elgin	60	£350,000
Cawdor	60	£260,000
Lhanbryde	30	£75,000
Forres	10	£220,000

Table 1: Main areas with a risk of river flooding

Lhandbryde and Forres (Burn of Mosset) both benefit from a flood protection scheme, which provides protection against flooding up to 1 in 100 year event, with an additional allowance for climate change. The assessment of the number of properties at risk in Lhandbryde and Forres in Table 1 is based on the 1 in 200 year event and does not take account of the residual protection provided by the flood protection scheme. The actual number of properties at risk therefore will be significantly less than reported in Table 1.

Economic activity and infrastructure at risk

The Annual Average Damages from river flooding are estimated to be £2.4 million. This accounts for around 41% of the estimated damages for the Findhorn, Nairn and Speyside Local Plan District. The damages are distributed as follows:

- 58% residential properties (£1.4 million)
- 22% non-residential properties (£520,000)
- 6% agriculture (£150,000)
- 6% emergency services (£140,000)
- 5% roads (£120,000)
- 2% vehicles (£55,000).

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

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.

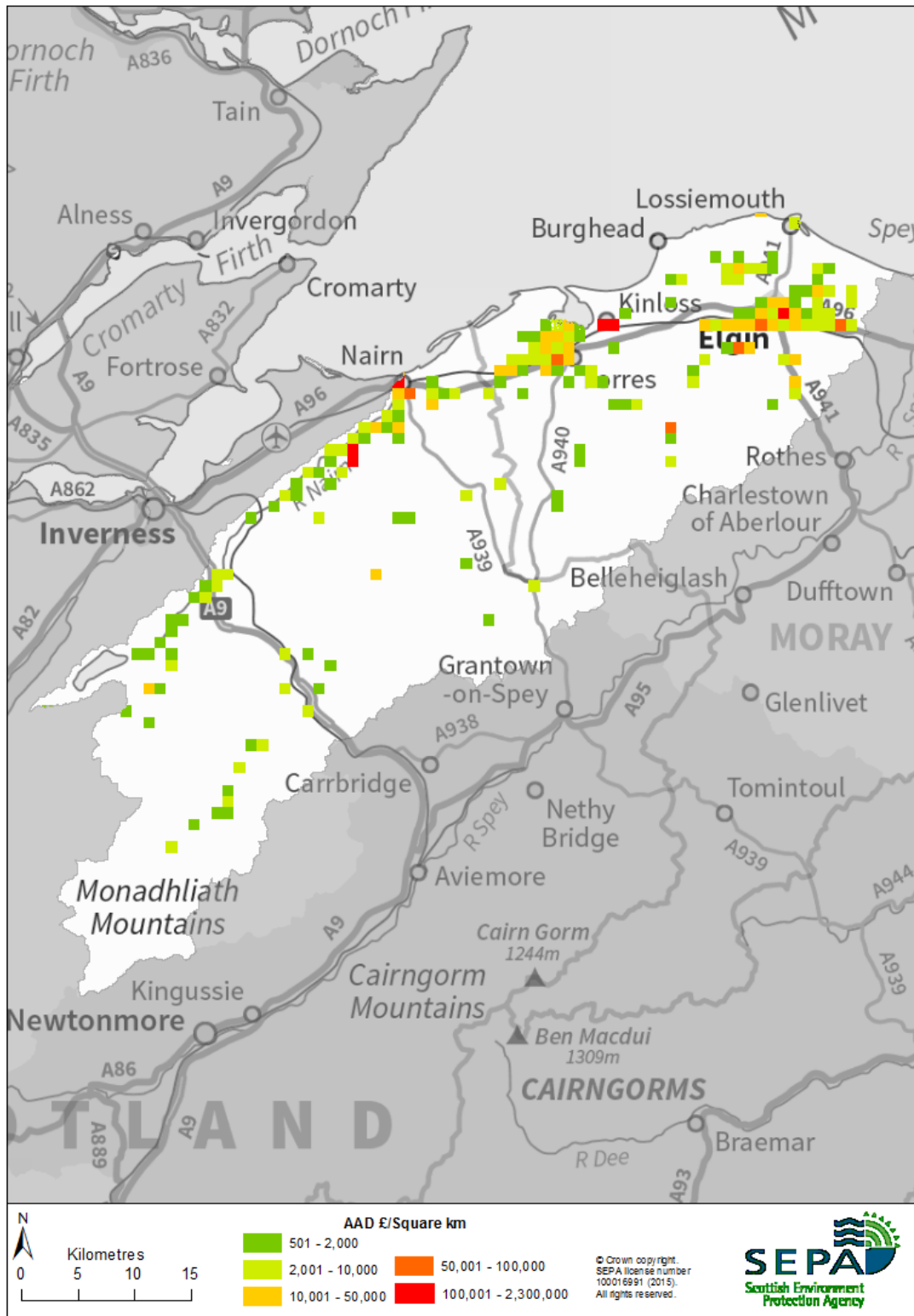


Figure 2: Annual Average Damages from river flooding

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 healthcare facilities
Utility assets	<10	Includes; electricity substations, telephone exchanges and fuel extraction sites
Roads (excluding minor roads)	400 locations	Includes the A96
Railway routes	40 locations	Aberdeen to Inverness
Agricultural land (km²)	70	n/a

Table 2: Infrastructure at risk of river flooding

Designated environmental and cultural heritage sites at risk

Within the catchment there are 44 designated cultural heritage sites at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes and listed buildings.

Approximately 7km² of designated environmental area is at risk of river flooding, including Special Areas of Conservation, Special Protection Areas, and Sites of Special Scientific Interest. Sites potentially affected include lochs, forests, rivers, and coastline. The designated sites which have the largest areas at risk include Loch Spynie and Culbin Sands, Culbin Forest and Findhorn Bay. However, some sites benefit from or are resilient to flooding.

History of river flooding

There have been a number of floods recorded which were caused by flooding from the River Nairn, River Findhorn, Burn of Mosset, Lhanbryde Burn, River Lossie, and Linkwood Burn. The earliest recorded flood was in 1829 when the Great Muckle Spate flooded large areas of north east Scotland, including Forres. The River Findhorn flooded in 1970. In 1997 Mosset, Lhanbryde and parts of the Lossie catchment flooded. More recently the River Lossie flooded in 2002.

In August 2014, large parts of north east Scotland were impacted by flooding. The River Lossie experienced a significant spate however, the partially complete flood defences in Elgin held out. Around 45 properties were however affected by flooding in Dallas. The transport network was affected after the railway line was flooded and the road at Delnies, near Nairn, was washed away.

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 16 flood warning areas for river flooding in this catchment group (Table 3). The majority of the flood warning areas are associated with the River Findhorn through the Forres area and the River Lossie through the Elgin area. The locations of the flood warning areas are shown in Figure 3.

Flood warning area	Number of properties within flood warning area	% of properties registered (January 2014)
Borough Briggs	142	37%
Broom of Moy	53	47%
Cooper Park	40	23%
Dallas	73	26%
Forres	1,493	29%
Glen Moray Distillery	54	4%
Kingsmill	353	64%
Miltoduff	39	31%
Miltoduff Distillery	1	100%
Old Mills	27	59%
Red Craig	36	47%
Tyock, Chanonry and Elgin East End	850	46%
Waterford, Seafield and Invererne	24	46%
Nairn (River Park)	65	22%
Nairn	92	33%
Nairn (Cawdor)	18	17%

Table 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 Findhorn group catchment may increase by 24%. This would potentially increase in the number of residential properties at risk of river flooding from approximately 460 to 770, and the number of non-residential properties from approximately 100 to 140.

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.

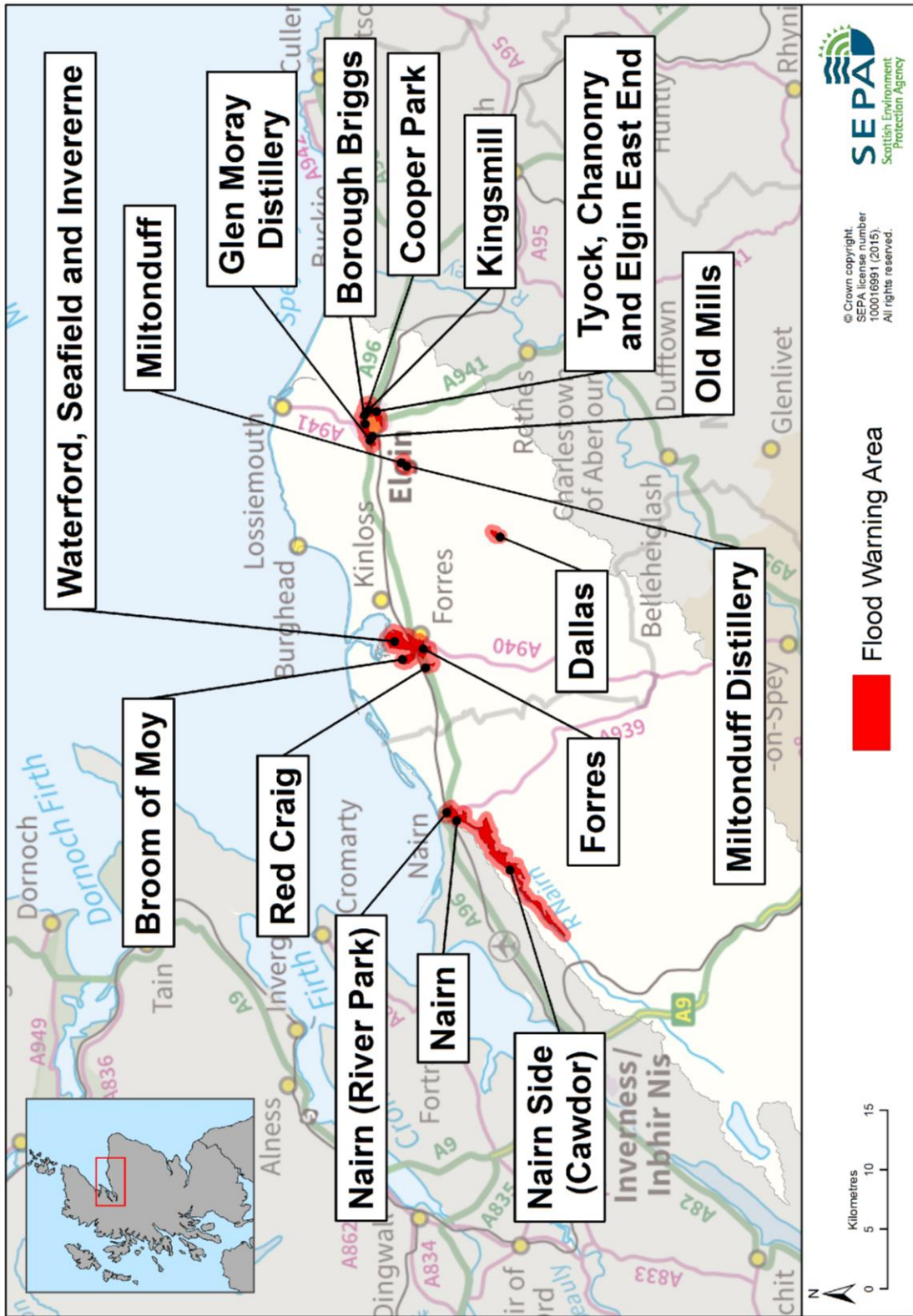


Figure 3: Flood warning areas

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 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 with the potential to help manage flooding by reducing runoff within the Findhorn river catchment group. However, as the areas of potential for runoff reduction are neither within nor immediately adjacent to any of the Potentially Vulnerable Areas, it is unlikely that rainfall runoff measures will have a significant impact on flood risk.

Floodplain storage

There are significant areas with potential for floodplain storage within this catchment group, particularly in the vicinity of the main urban areas covered by the Potentially Vulnerable Areas. It is possible that floodplain storage could reduce flood risk and the practicality of enhancing storage of flood water could be considered further for all seven Potentially Vulnerable Areas within the Findhorn catchment group.

Sediment management

Although a lot of the river systems have substantial reaches which are in approximate balance, there are also significant lengths of river where sediments are predominantly either being eroded or deposited. The Potentially Vulnerable Areas which show the largest amount of erosion or deposition are Spynie (05/02), Lhanbryde (05/03), Elgin (05/05), and Forres (05/06). Actions taken to manage sediment in these Potentially Vulnerable Areas could potentially reduce flood risk.

3.3 Coastal flooding

Findhorn, Nairn and Speyside Local Plan District Portgordon to Nairn

This chapter provides supplementary information on flooding for the coastal area. 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 in Section 2.

In the Findhorn, Nairn and Speyside Local Plan District, coastal flooding is reported across one coastal area: Portgordon to Nairn.

Coastal overview

The Portgordon to Nairn coastal area covers approximately 68km of the Moray Firth coastline from Portgordon in the east to Nairn in the west (Figure 1). There are several towns and villages located close to the coastline including Kingston, Lossiemouth, Hopeman, Burghead, Findhorn, and Nairn. The coastal area contains two local authorities; Moray Council and The Highland Council.

The coastal area is characterised by a series of wide bays with four major rivers; the River Spey, the River Lossie, the River Findhorn, and the River Nairn, discharging into the Moray Firth.

The eastern part of the coastline along to Burghead is characterised by long beach areas¹. The eastern and central beaches around Spey Bay are predominantly shingle and the spit towards Lossiemouth is predominantly sandy, backed with a dune ridge. Fresh beach material is supplied by erosion of glacial shingle deposits and from the River Spey (one of the few rivers in Scotland still acting as a major source of beach material).

There are six Potentially Vulnerable Areas:

- Burghead to Lossiemouth (05/01)
- Spynie (05/02)
- Lhanbryde (05/03)
- Spey Bay (05/04)
- Forres (05/06)
- Nairn East and Auldearn (05/08).

¹ Much of the information in this section has been taken from Scottish Natural Heritage Research, Survey and Monitoring Report No. 152. Coastal Cells in Scotland: Cell 11 – Shetland (DL Ramsay and AH Brampton, 2000).

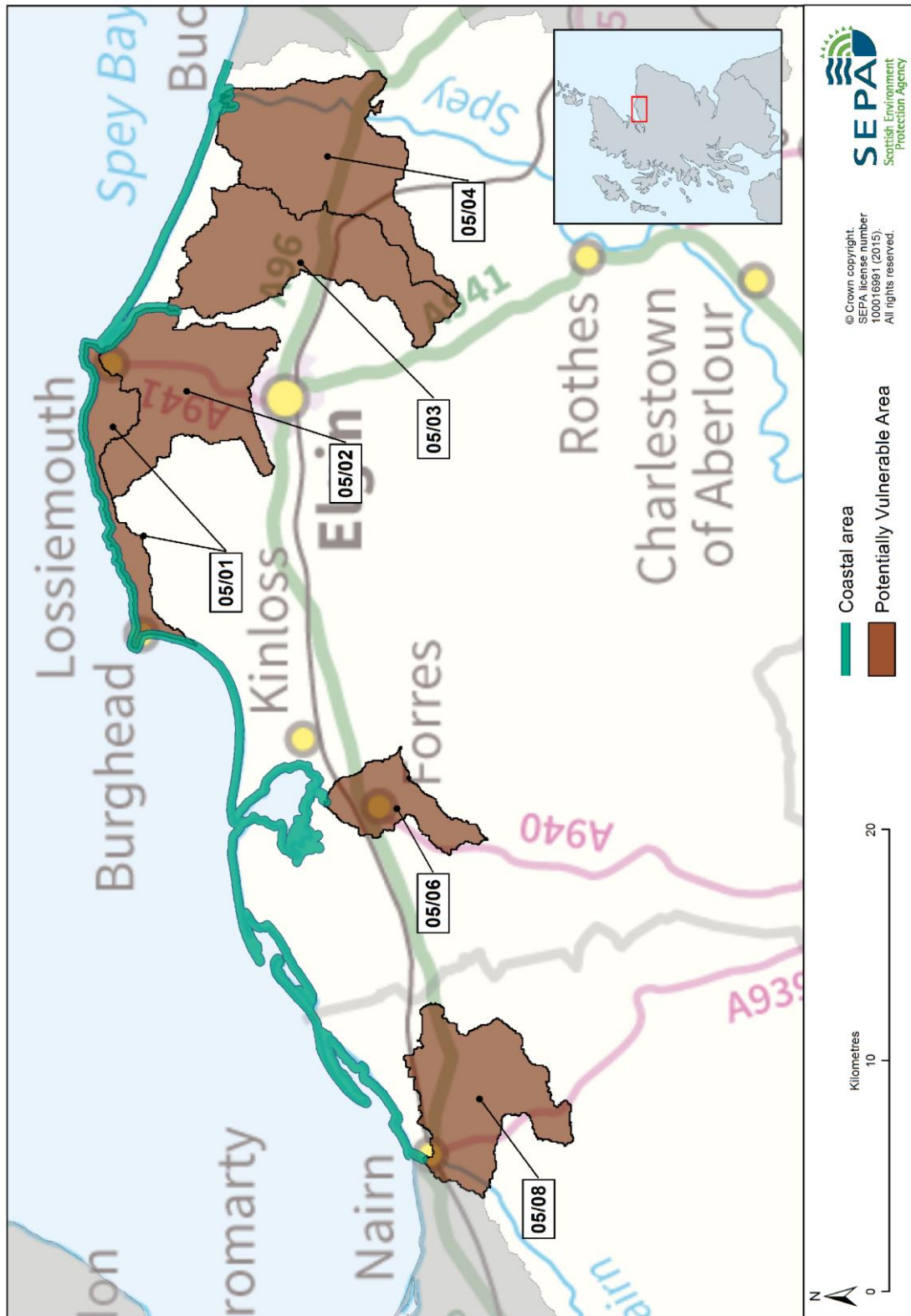


Figure 1: Portgordon to Nairn coastal area and Potentially Vulnerable Areas

Flood risk

Within the Portgordon to Nairn coastal area, there are approximately 130 residential and 30 non-residential properties at risk of coastal flooding. Approximately 64% of residential properties and 50% of non-residential properties at risk are located within Potentially Vulnerable Areas.

Main areas at risk

The majority of residential properties at risk of coastal flooding are located in the Seatown area of Lossiemouth. The Potential Vulnerable Areas that have more than 20 properties at risk of coastal flooding are shown in Table 1. Note that the totals in Table 1 include the whole of the town of Nairn however, only a small part of Nairn is located in this 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.

	Residential and non-residential properties at risk of coastal flooding	Annual Average Damages
Lossiemouth	70	£230,000
Findhorn and Kinloss	50	£86,000
Nairn (total for Local Plan District 1 and 5)	130	£200,000

Table 1: Main areas at risk of coastal flooding

Economic activity and infrastructure at risk

The Annual Average Damages from coastal flooding in the Portgordon to Nairn coastal area are approximately £430,000. Coastal flooding accounts for around 7% of the total damages for the Findhorn, Nairn and Speyside Local Plan District. The damages are distributed as follows:

- 68% residential properties (£290,000)
- 15% roads (£65,000)
- 6% emergency services (£26,000)
- 5% agriculture (£20,000)
- 4% vehicles (£18,000)
- 3% non-residential properties (£16,000).

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

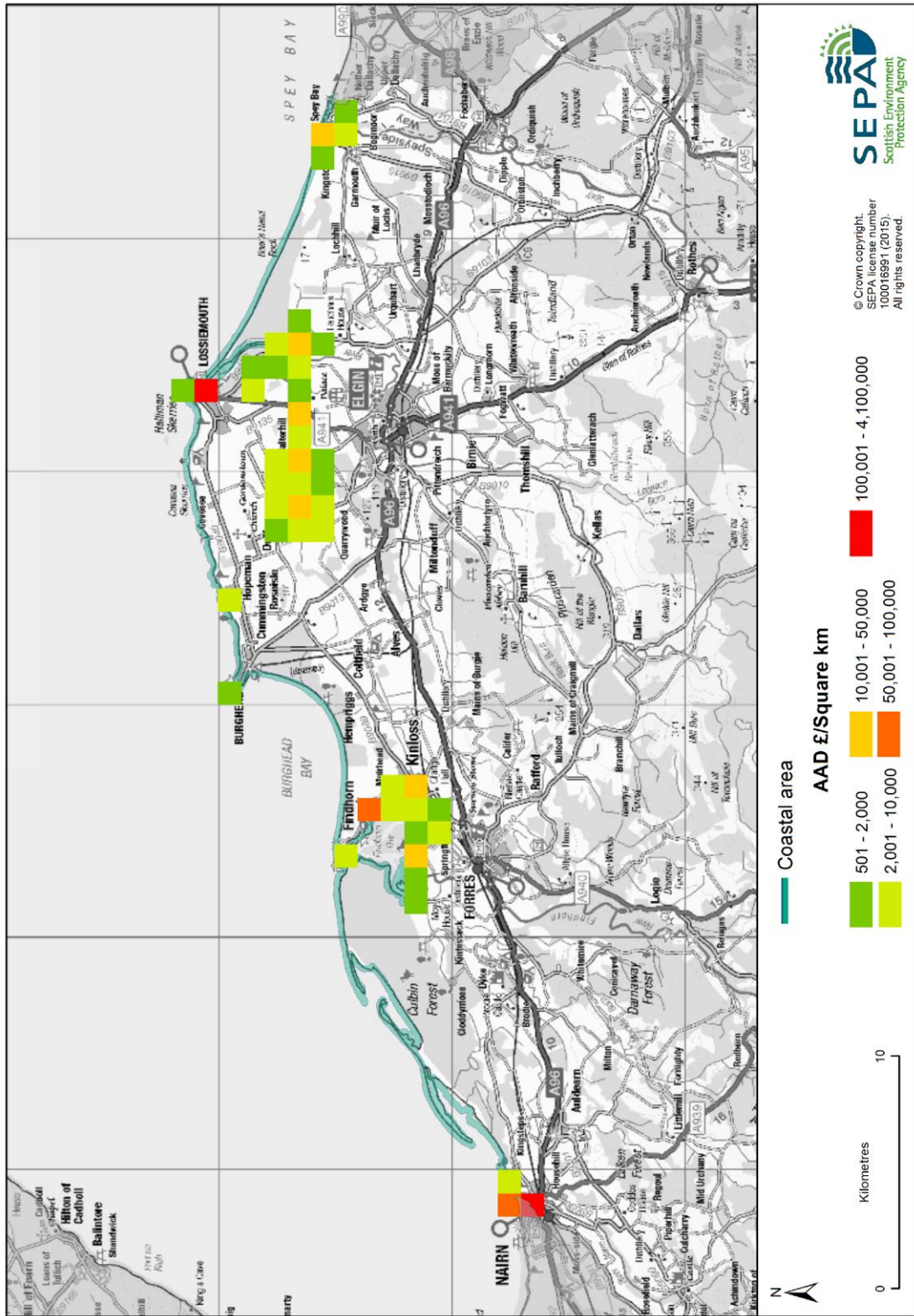


Figure 2: Annual Average Damages from coastal flooding

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

	Number at risk	Further detail
Community facilities	0	n/a
Utility assets	0	n/a
Roads (excluding minor roads)	50	Notably; A941, B9011, and B9103
Railway routes	1	Aberdeen to Inverness
Agricultural land (km ²)	16	n/a

Table 2: Infrastructure and agriculture at risk of coastal flooding

Designated environmental and cultural heritage sites at risk

There are nine designated cultural heritage sites that have a risk of coastal flooding including scheduled monuments and gardens and designed landscapes.

Approximately 17km² of environmental 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 Loch Spynie, Culbin Bar, Culbin Sands, Culbin Forest, and Findhorn Bay.

History of flooding

There have been a number of localised floods with wave action often increasing flood risk. In February 1983 Shore Street in Lossiemouth flooded and a section of the harbour wall was breached. More recently flooding occurred in December 2012, December 2013 and January 2014. Properties had to be evacuated and people had to be rescued from flooded vehicles. Several properties were flooded. 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 Portgordon to Nairn coastal area benefits from the Moray Firth Coastal Flood Warning Scheme. There are three coastal flood warning areas: Ardersier to Nairn, Findhorn to Lossiemouth and Spey Viaduct to Spey Bay (Figure 3).

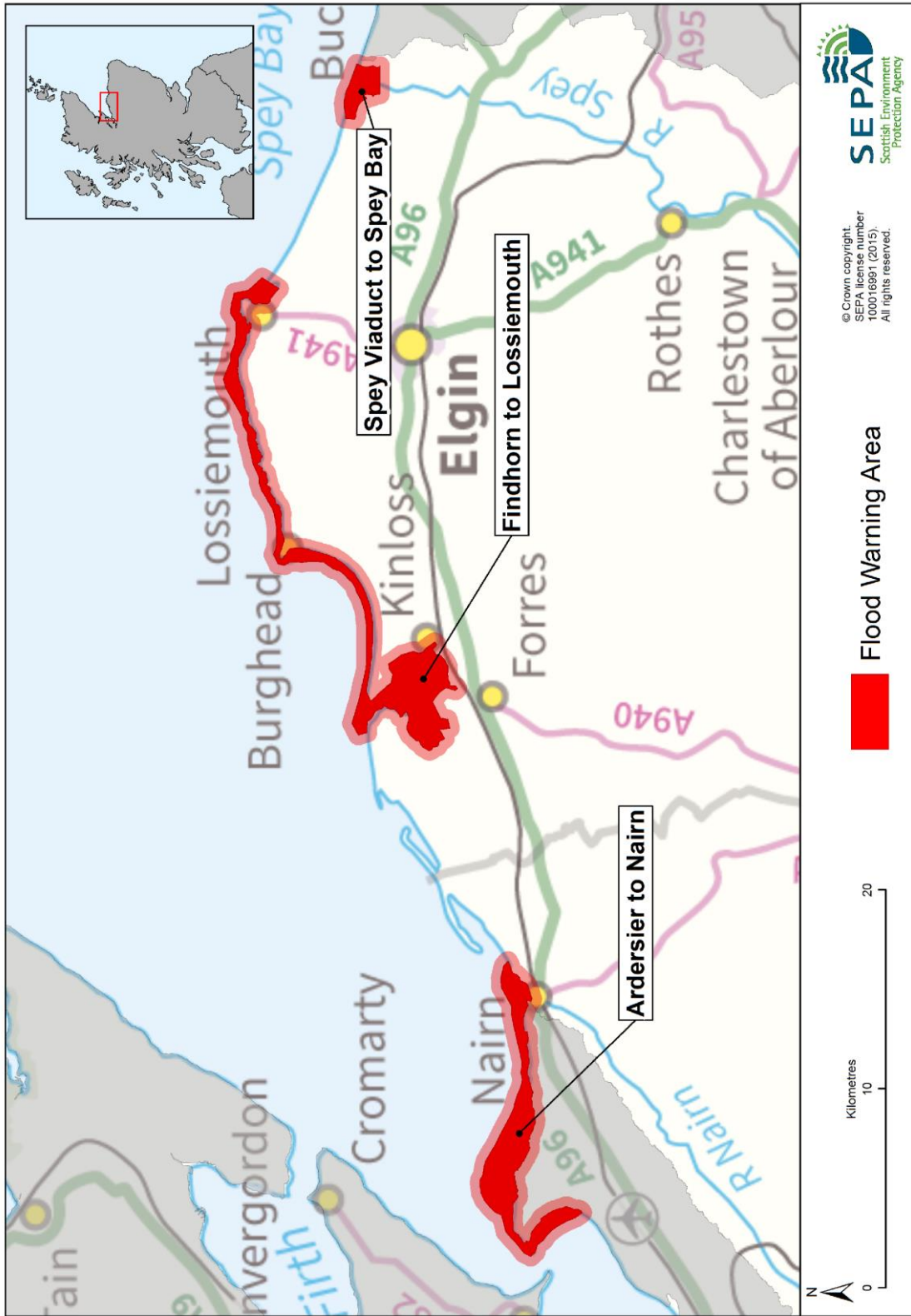


Figure 3: Flood warning areas

Awareness raising campaigns and community groups

There are a number of different action groups in this area including the Innes Community Council and the Flood Action Group in Kingston.

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 Portgordon to Nairn coastal area is 0.5m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 130 to 220, and the number of non-residential properties from approximately 30 to 70. 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 online 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 Portgordon to Nairn Coastal Area the only areas of potential for estuarine surge attenuation are located in the east, around Lossiemouth and Kingston.

Wave energy

There is potential for wave energy dissipation along much of the coastline in this coastal area. Between Nairn to Lossiemouth there is a substantial amount of potential, particularly around Findhorn Bay, the eastern half of Burghead Bay and the Culbin Forest frontage.

3.4 Surface water flooding

Findhorn, Nairn and Speyside 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 the history of surface water flooding. The predicted impacts on infrastructure are also identified. 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 Section 2.

Flood risk

Within the Findhorn, Nairn and Speyside Local Plan District there are approximately 730 residential properties and 340 non-residential properties at risk of surface water flooding. 77% of the residential properties at risk from surface water flooding are located within Potentially Vulnerable Areas.

Main areas at risk

The main areas which have greater than 50 residential properties at risk of surface water flooding are shown in Table 1. 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
Forres	230	£170,000
Elgin	150	£140,000
Rothes	70	£150,000
Aviemore	80	£89,000

Table 1: Main areas at risk of surface water flooding

Economic activity and infrastructure at risk

The Annual Average Damages in the Findhorn, Nairn and Speyside Local Plan District from surface water flooding are estimated to be £1.2 million. This accounts for 21% of the Annual Average Damages for the Local Plan District. The damages are distributed as follows:

- 53% residential properties (£660,000)
- 38% non-residential properties (£470,000)
- 5% emergency services (£57,000)
- 3% roads (£37,000)
- 1% vehicles (£11,000).

Figure 1 shows 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 Rothes, Elgin and Forres.

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

	Number at risk	Further detail
Community facilities	10	Includes; educational buildings and emergency services.
Utility assets	70	Includes; electricity substations, electricity generation and fuel extraction sites.
Roads (excluding minor roads)	1,900 locations	Notably; A941, A95, A96
Railway routes	190 locations	Aberdeen to Inverness

Table 2: Infrastructure at risk of surface water flooding

Designated environmental and cultural heritage sites at risk

Within the Findhorn, Nairn and Speyside Local Plan District it is estimated that approximately 90 cultural heritage sites are at risk of surface water flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefields and listed buildings.

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

History of surface water flooding

In July 1997, a combination of surface water flooding and river flooding led to significant impacts in Elgin. As a consequence, 1,200 people were evacuated from Elgin and approximately 400 homes were flooded. Roads, railway lines, buildings and fields were flooded when the defences were breached. This caused an estimated £35 million in flood damages.

Rothes experienced significant surface water flooding in addition to river flooding in 2002 and 2009. Forres has historically experienced fairly significant surface water flooding. There have also been a number of other recent localised surface water floods, including at Newmill and Hopeman. Elgin suffered from surface water flooding in 2014, particularly around the railway station.

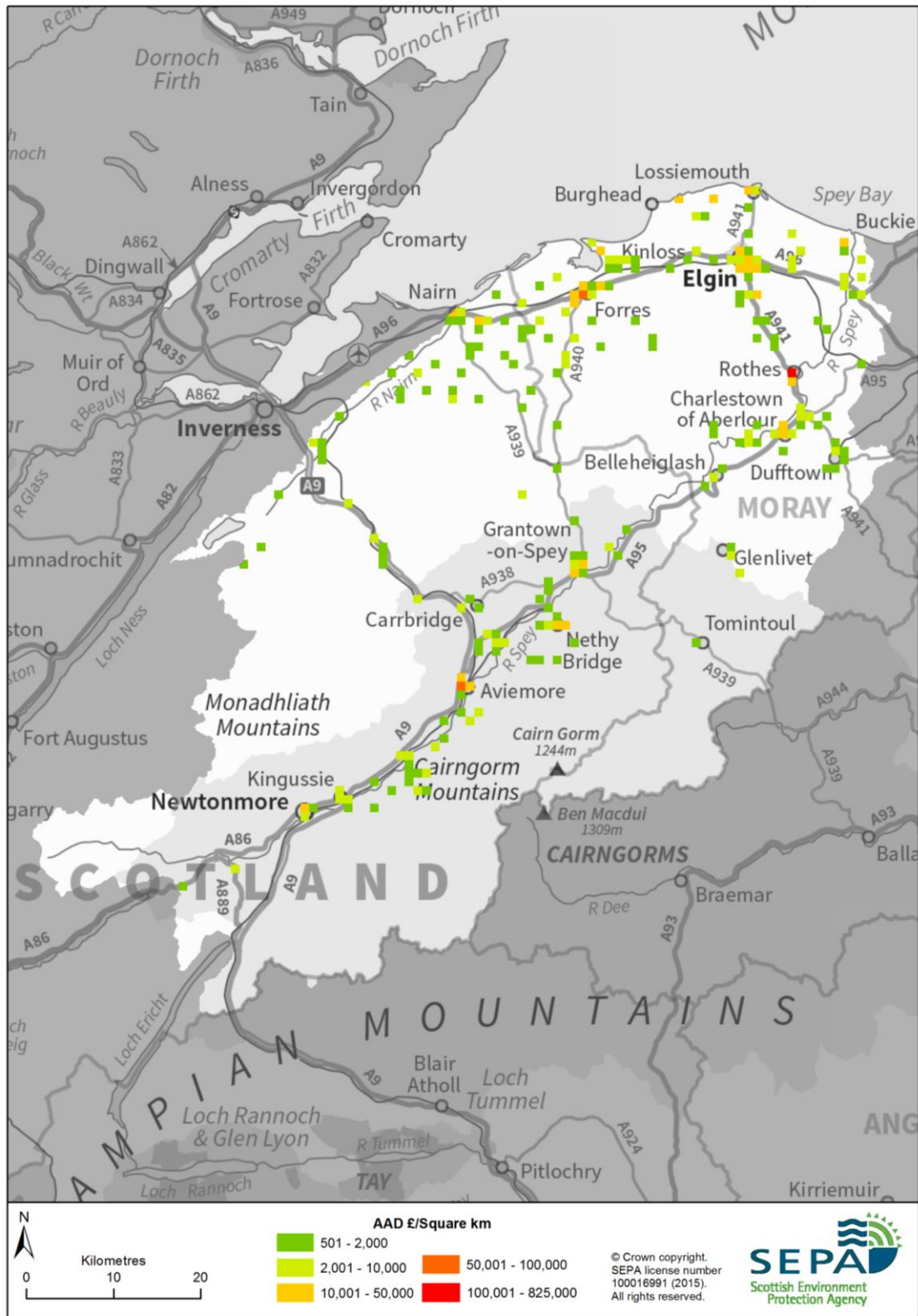


Figure 1: Annual Average Damages from surface water flooding

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.

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 730 to 940 and the number of non-residential properties from approximately 340 to 440.

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.