

REPORT TO: Cabinet

MEETING DATE: 13 May 2014

BY: Depute Chief Executive (Partnerships and Community Services)

SUBJECT: Flood Risk Management

1 PURPOSE

- 1.1 To update Cabinet on the implementation of the Flood Risk Management (Scotland) Act 2009 and specifically the Flood Risk Management Strategy procedure.

2 RECOMMENDATIONS

- 2.1 That Cabinet note the requirements of the Flood Risk Management (Scotland) Act 2009 and approve the Characterisation Reports as part of the ongoing Flood Risk Management Strategy process.

3 BACKGROUND

- 3.1 The Flood Risk Management (Scotland) Act 2009 (the FRM Act) received royal assent on the 16th June 2009. This legislation has important implications for local authorities.
- 3.2 The purpose of the FRM Act is to improve the assessment and sustainable management of flood risk across Scotland. This is supported by a new duty on local authorities, SEPA, Scottish Ministers and others to co-operate with each other and exercise their flood risk related functions with a view to reducing overall flood risk.
- 3.3 An important new element of flood risk management established under the FRM Act is a requirement to prepare plans to manage flood risk. These plans will provide a framework for coordinating actions across catchments to deal with all forms of flooding and its impacts. They will also help ensure flood management decisions balance local and national priorities and provide a basis for long-term planning.

- 3.4 As part of this process, the FRM Act requires the preparation of a series of assessments and maps to underpin the production of Flood Risk Management Strategies by SEPA by December 2015 and then, the preparation of local Flood Risk Management Plans by local authorities by June 2016. See Figure 3 of the attached appendix entitled Flood Risk Management Strategies and Local Flood Risk Management Plans December 2011 (Appendix 1), for a timeline.

Local Plan Districts and Potentially Vulnerable Areas

- 3.5 The National Flood Risk Assessment was completed in December 2011 and the formation of Local Plan Districts (LPD) and Potentially Vulnerable Areas (PVA) was the first stage of delivering the new planning arrangements set out in the FRM Act.
- 3.6 Local Plan Districts are the geographical areas for which Flood Risk Management Plans will be produced. There are 14 LPDs covering all of Scotland. East Lothian is part of the Forth Estuary LPD (LPD 10). The boundaries for LPDs are shown in Figure 3 of Appendix 1.
- 3.7 Based on the National Flood Risk Assessment, and following public consultation, SEPA has identified those areas where the scale of potential flood impacts is sufficient to justify further strategic planning. These areas are termed Potentially Vulnerable Areas, and will be the focus for Flood Risk Management Strategies and Local Flood Risk Management Plans.
- 3.8 There are 6 PVAs in East Lothian: 10/20 Edinburgh Coastal (small area in East Lothian); 10/21 Musselburgh Coastal; 10/22 River Esk; 10/23 East Lothian Coastal (Prestonpans to Aberlady); 10/24 River Tyne; 10/25 East Lothian Coastal (Dunbar & West Barns). The extent of the PVAs is shown on the attached location plan.

Flood Risk Management Strategies & Local Flood Risk Management Plans

- 3.9 SEPA published the new Flood Maps on their website on 15 January 2014 and, in consultation with Local Authorities and Scottish Water, is undertaking strategic appraisals of flood risk management measures to inform the development of Flood Risk Management Strategies across Scotland.
- 3.10 The Flood Risk Management Strategies will identify the main flood hazards and impacts, setting out objectives for reducing risk and the best combination of actions to achieve this, such as the appropriateness of an alleviation scheme or improving flood warning arrangements.
- 3.11 The Local Flood Risk Management Plan takes these objectives and explains what actions will be taken by whom and at what time to deliver them within a six-year planning cycle. The first cycle will run from 2015 to 2021. In the interim, flood risk will be addressed by the Council's Severe Weather Response Plan.

- 3.12 The first stage of the Strategic Appraisal process is the production of Characterisation Reports for the LPD which identify the main flood hazards and impacts from each source of flooding – Coastal, River (Fluvial) and Surface Water (Pluvial).
- 3.13 Each stage of the appraisal process requires to be ‘signed off’ by each Local Authority. The Characterisation Report for coastal flooding is attached. This is entitled Section 3: Main catchments and coastal areas within Forth estuary local plan district. The Report for river flooding is still in early draft stage.
- 3.14 Approval is required for the level of flood risk, the existing measures to manage flood risk and the significant historical flood events identified in the Reports.
- 3.15 SEPA have intimated that the exact content of the Reports may change prior to publication in December but there will be no fundamental changes without any prior consultation with the local authorities.

4 POLICY IMPLICATIONS

- 4.1 The Flood Risk Management (Scotland) Act 2009 places a statutory responsibility on the Local Authority to exercise their flood risk related functions with a view to reducing overall flood risk and complying with the EC Floods Directive. A key responsibility is the preparation of a Flood Risk Management Strategy & Local Flood Risk Management Plan in accordance with the Directive.

5 EQUALITIES IMPACT ASSESSMENT

- 5.1 This report is not applicable to the well being of equalities groups and an Equalities Impact Assessment is not required.

6 RESOURCE IMPLICATIONS

- 6.1 Financial - The financial provision for the preparation of the Flood Risk Management Strategy and Plans will be allocated from the 2014/15 Flooding and Coastal Protection budgets.

Provision for Flood Protection Schemes identified in the Flood Risk Management Plan will be required in future years and will be influenced by future settlements from the Scottish Government

- 6.2 Personnel - None
- 6.3 Other - None

7 BACKGROUND PAPERS

7.1 None

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Flood Risk Management Strategies and Local Flood Risk Management Plans

December 2011

Flood Risk Management (Scotland) Act 2009

Flood Risk Management Strategies and Local Flood Risk Management Plans

This document is being published alongside Scotland's first National Flood Risk Assessment. It provides detail on the content and production of Flood Risk Management Strategies and Local Flood Risk Management Plans. These strategies and local plans take forward the Flood Risk Management Planning process set out by the Scottish Government in the Flood Risk Management (Scotland) Act 2009, and taken together will deliver the requirement for Flood Risk Management Plans. Extensive arrangements will be published in early 2012.

The approach described in this document was developed in partnership with the Scottish Advisory and Implementation Forum for Flooding (SAIFF), which has representation from the Scottish Government, local authorities and Scottish Water. This document is aimed at responsible authorities and other stakeholders with an interest in flooding issues across Scotland. Designated responsible authorities are currently local authorities and Scottish Water.

Flood Risk Management Planning in Scotland

The National Flood Risk Assessment

The publication of the first National Flood Risk Assessment in December 2011 represents a major milestone in improving Scotland's understanding and management of flood risk. The assessment is the first of its kind in Scotland, assessing the likelihood of flooding from rivers, groundwater and the sea, as well as flooding caused when heavy rainfall is unable to enter drainage systems or the river network. The likelihood of flooding is considered alongside the estimated impact on people, the economy, cultural heritage and the environment. This combined understanding of where flooding is likely to occur, and the impact when it does, will allow Scotland to target its effort in managing the future risks to people and property.

Local Plan Districts and Potentially Vulnerable Areas

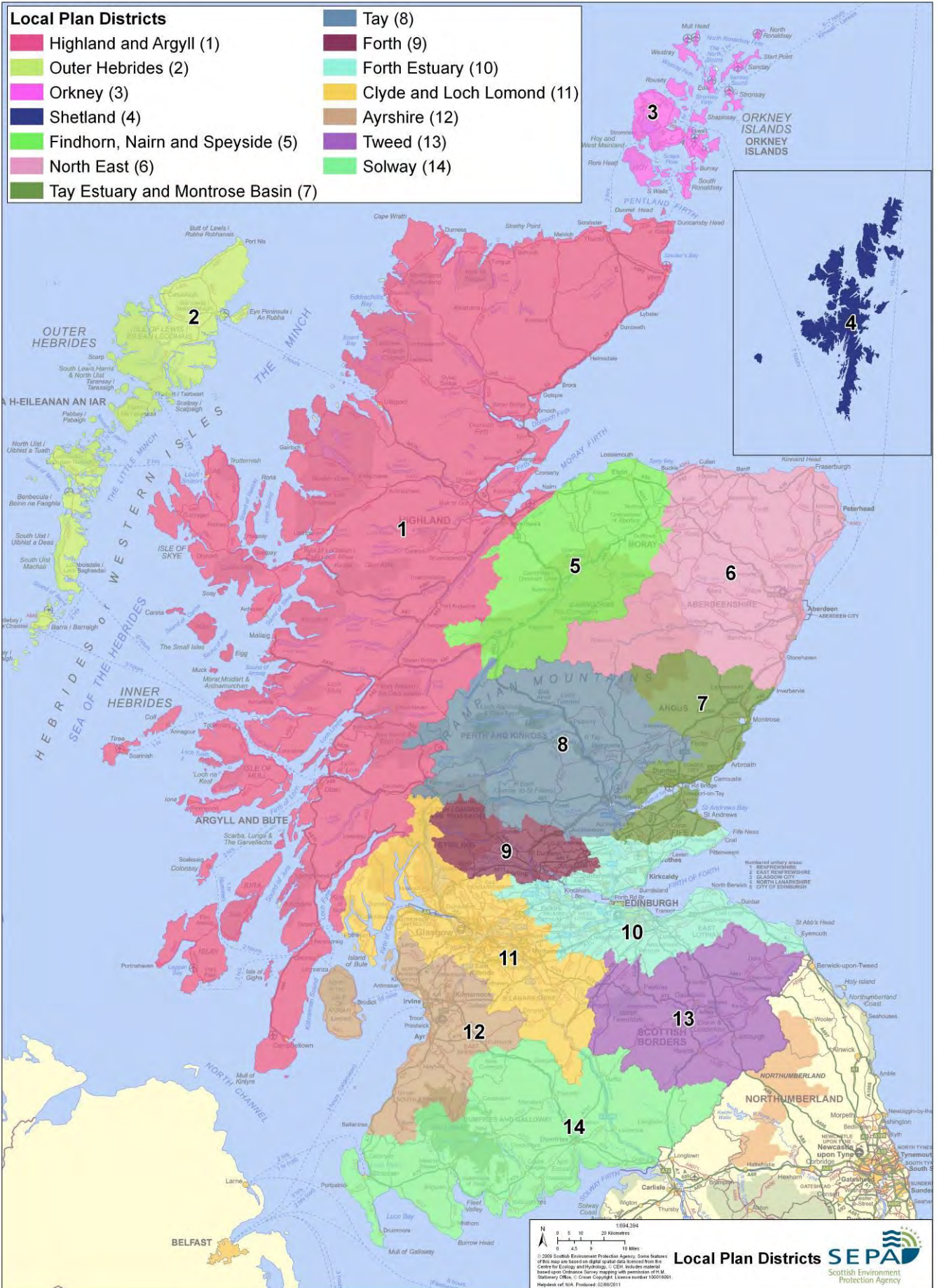
The completion of the National Flood Risk Assessment and the agreement of Local Plan Districts and Potentially Vulnerable Areas is the first stage of delivering the new planning arrangements set out in the Flood Risk Management (Scotland) Act 2009 (FRM Act). Local Plan Districts are the geographical areas for which Flood Risk Management Plans will be produced. There are 14 Local Plan Districts covering all of Scotland. The boundaries for Local Plan Districts are shown in **Figure 1**.

Based on the National Flood Risk Assessment, and following public consultation, SEPA has identified those areas where the scale of potential flood impacts is sufficient to justify further strategic planning. These areas are termed Potentially Vulnerable Areas (PVAs), and will be the focus for Flood Risk Management Strategies and Local Flood Risk Management Plans.

Local partnerships and advisory group arrangements

For each Local Plan District a lead local authority will be identified, a partnership formed between the local authorities, Scottish Water and SEPA, and a local advisory group established to draw upon the knowledge of the wider stakeholder community. More information on the lead local authorities, local partnerships and the local advisory group arrangements will be available in *Flood Risk Management Planning in Scotland: Arrangements for 2012 – 2016* (to be published in early 2012).

Figure 1: Local Plan Districts



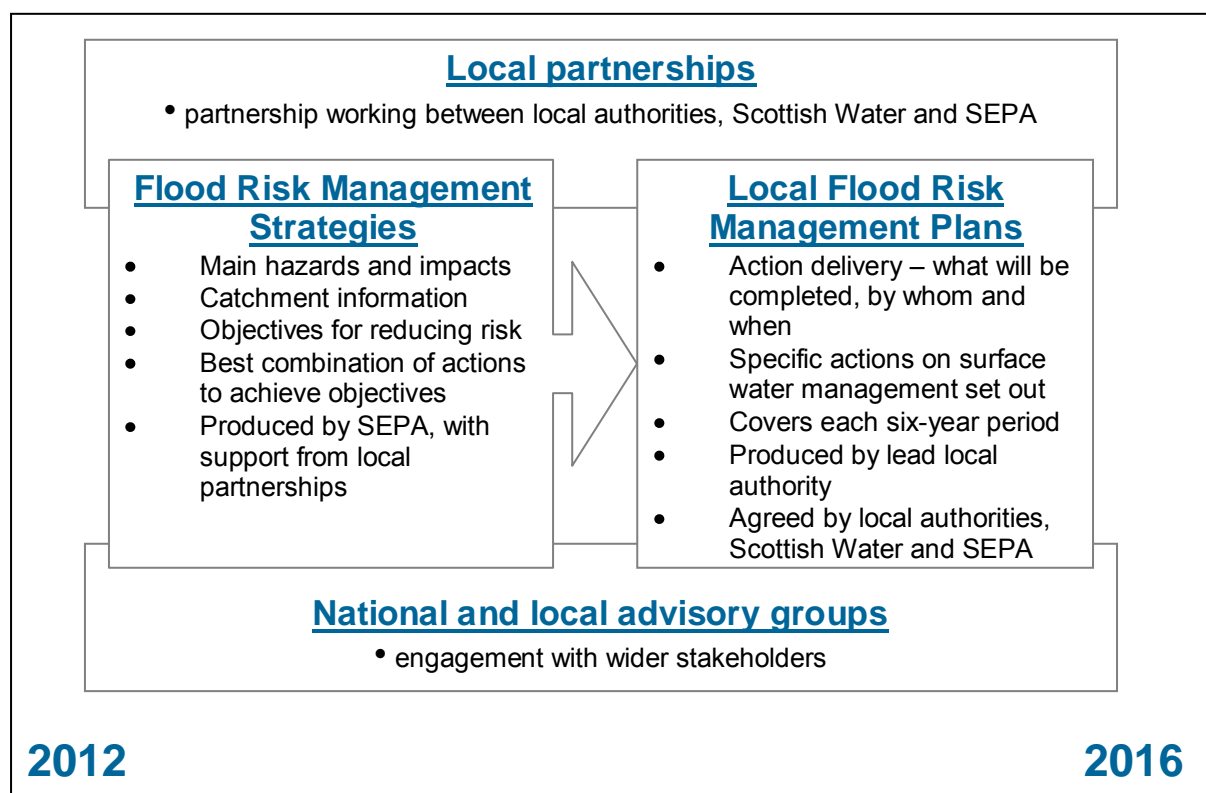
Flood Risk Management Strategies and Local Flood Risk Management Plans

The FRM Act requires the production of Flood Risk Management Plans covering each Local Plan District. There will be two sets of complementary plans, Flood Risk Management Strategies produced by SEPA and Local Flood Risk Management Plans produced by lead local authorities.

The Flood Risk Management Strategies will identify the main flood hazards and impacts, setting out objectives for reducing risk and the best combination of actions to achieve this, such as the appropriateness of an alleviation scheme or improving flood warning arrangements¹. The Local Flood Risk Management Plan takes these objectives and explains what actions will be taken by whom and at what time to deliver them within a six-year planning cycle. The first cycle will run from 2015 to 2021.

National consistency and strategic decision-making will be balanced with local knowledge and accountability in the preparation, approval and implementation of these documents. These plans, taken together, will form a single point of reference to describe public bodies' response and commitment to address flooding issues. **Figure 2** shows the relationship between Flood Risk Management Strategies and Local Flood Risk Management Plans, and how their development is supported by local partnerships and advisory groups.

Figure 2: Requirements for each Local Plan District



¹ The Flood Risk Management Act uses the term 'measures' to describe flood risk management activity. This document uses the term 'actions'.

Flood Risk Management Strategies

The purpose of a Flood Risk Management Strategy is to summarise the main flooding issues and impacts within each Local Plan District. The strategies will set out the best combination of actions to address the impacts identified in each Potentially Vulnerable Area within a Local Plan District using a nationally consistent approach.

Flood Risk Management Strategies will be led and prepared by SEPA in a consistent format with close consultation with local authorities and Scottish Water. The strategies will contain catchment-based information on, for example: the number of people at risk, economic impacts of flooding, catchment hydrology, land-use, geomorphology, climate change and long-term development plans. This background information will be drawn together by SEPA by the end of April 2012.

The Flood Risk Management Strategies will also include more detailed assessments such as flood hazard and flood risk maps, and an assessment of the potential contribution of natural flood management techniques. These assessments and maps will be drawn together by SEPA with input from the local partnerships by December 2012. This is in advance of the dates required in legislation, but will allow sufficient time for the appraisal of actions and agreement of priorities within the strategies to inform the drafting of the Local Flood Risk Management Plans from 2013 onwards.

Working jointly with the local partnership, SEPA will agree objectives for addressing the main flooding impacts in each Local Plan District. Actions to meet the agreed objectives will then be appraised to ensure the right combinations are identified and prioritised. It is these risk-based objectives and actions that will be used by government and local authorities to help target investment to areas where impacts are greatest and which have the greatest potential for public benefit to be achieved.

Objectives and actions set out in the Flood Risk Management Strategies will be developed around the principles published in the Scottish Government's guidance on *Delivering Sustainable Flood Risk Management* (June 2011):

- Avoid an increase in flood risk, eg provide enhanced flood risk advice on planning applications;
- Protect by reducing the likelihood of flooding, eg by investing in new or by enhancing existing flood defences, and;
- Prepare to reduce the impacts of flooding, eg by raising public awareness or improving property-level resilience.

Working with local authorities and Scottish Water, SEPA will have set objectives and identified, appraised and prioritised the actions for each Local Plan District by the end of December 2014. The prioritisation process that assigns actions to a particular planning cycle will be based on a combination of the underlying evidence of proposed costs and benefits prepared by SEPA, local needs expressed through the local partnerships, and the availability of funding to deliver actions.

All 14 Flood Risk Management Strategies will be co-ordinated at a national level, and taken together will:

- Provide a national picture of flood risk and flood impacts for Scotland;
- Develop objectives for the management of flood risk based on long-term sustainable approaches, and;
- Ensure a nationally consistent and co-ordinated approach to flood risk management.

Flood Risk Management Strategies will be produced with advice from the national and local advisory groups. A draft of the Flood Risk Management Strategies will be prepared for consultation in December 2014 with a final set published in December 2015.

Refer to **Figure 3** for the key dates involved with the production of a Flood Risk Management Strategy and the alignment with the production of Local Flood Risk Management Plans.

Local Flood Risk Management Plans

The 14 Local Flood Risk Management Plans turn short term actions from each Flood Risk Management Strategy into a clear programme of work for each Potentially Vulnerable Area over the six-year period within each cycle. To ensure continuity with the Flood Risk Management Strategy, in addition to describing the implementation arrangements for the delivery of actions, the Local Flood Risk Management Plan will also summarise the key parts of the Strategy.

Local partnerships for Local Plan Districts will need to be established early in 2012. Preparatory work and information gathering to inform the production of the Flood Risk Management Strategy, including further local assessments and targeted modelling and mapping work, will be completed by the end of December 2013. This will need to include work to assess and prioritise surface water flooding issues.

Local Flood Risk Management Plans will take forward the objectives and actions set out in the relevant strategy, translating them into a short-term delivery plan. Where a proposed action has already undergone a detailed appraisal of its costs and benefits (and where it attracts local and national support and has been through the statutory approval process for funding), the timing, funding and co-ordination arrangements for its delivery will be described in the Local Flood Risk Management Plan. For example, the construction of a flood alleviation scheme will state where flooding will be reduced and the number of properties and infrastructure that will benefit from a reduction in flood risk. Where a detailed appraisal of actions has not yet been carried out by local stakeholders, the Local Flood Risk Management Plan will describe the arrangements by which organisations commit to investigate the costs and benefits of actions prioritised in the strategy.

Importantly, in addition to the prioritised actions set out in the Flood Risk Management Strategy, other local flood risk activity underway or planned by local authorities will be reported or referenced in the Local Flood Risk Management Plan. This will ensure that the Local Flood Risk Management Plan provides a comprehensive summary of local activity to manage flood risk within each Local Plan District.

The lead local authority for each Local Plan District will co-ordinate the production, consultation and publication of the Local Flood Risk Management Plan in consultation with relevant local authorities, Scottish Water and SEPA. Draft plans will be prepared by the end of December 2014 for consultation, although discussion and consultation on the implementation arrangements is expected to continue between local partners throughout 2015. A final set will be published by June 2016. These plans will only be finalised with the agreement of all the local authorities within the Local Plan District, Scottish Water and SEPA, thus placing emphasis on the importance of good working relations between all partners.

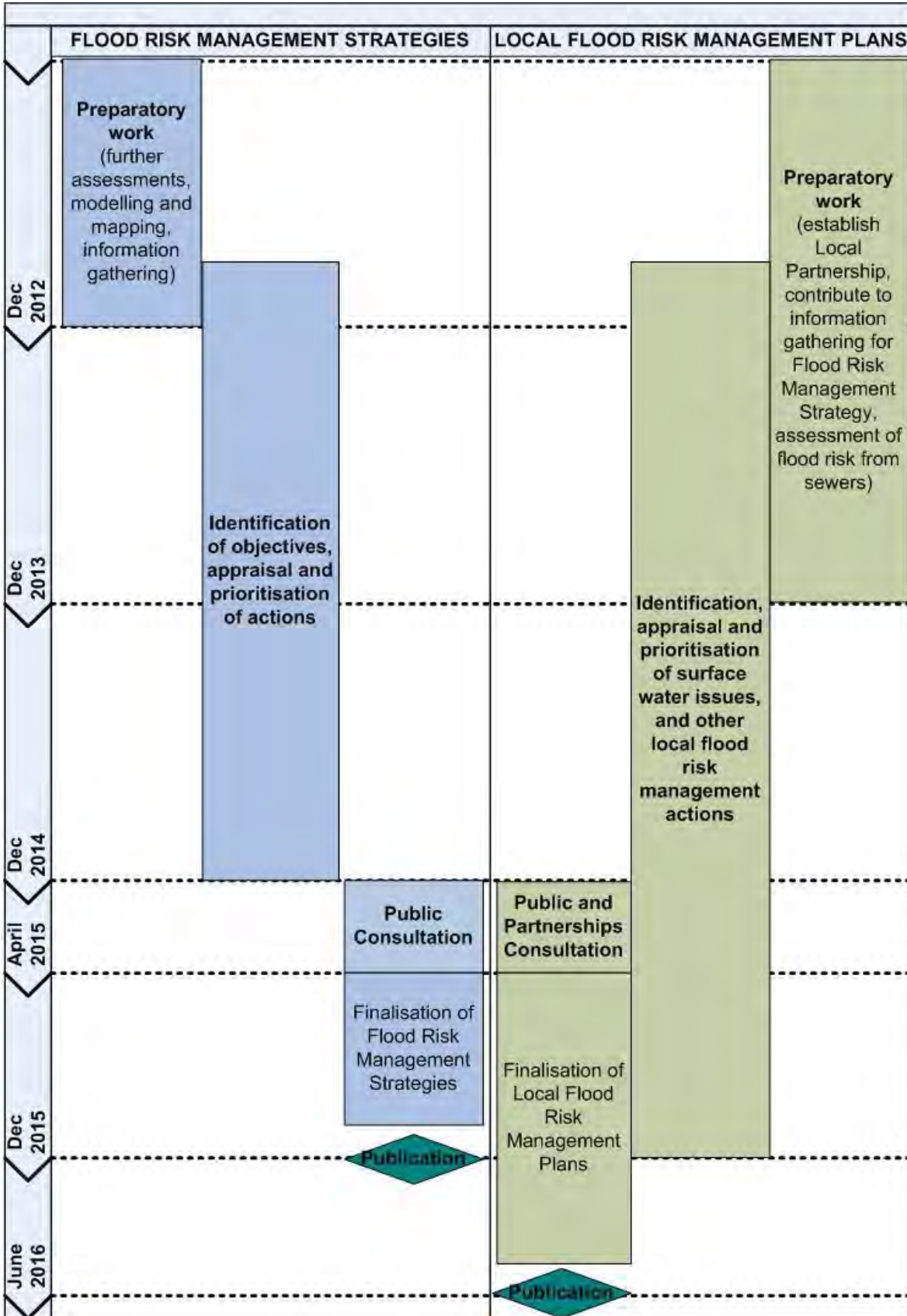
Refer to **Figure 3** for the key dates involved with the production of a Local Flood Risk Management Plan and alignment with the production of Flood Risk Management Strategies.

Next steps

More information on the flood risk management planning process will be available on SEPA's website in early 2012. A *Flood Risk Management Planning Arrangements 2012 – 2016* document will include information on the production of Flood Risk Management Plans, local partnerships, local advisory groups and co-ordination with River Basin Management Planning and development planning.

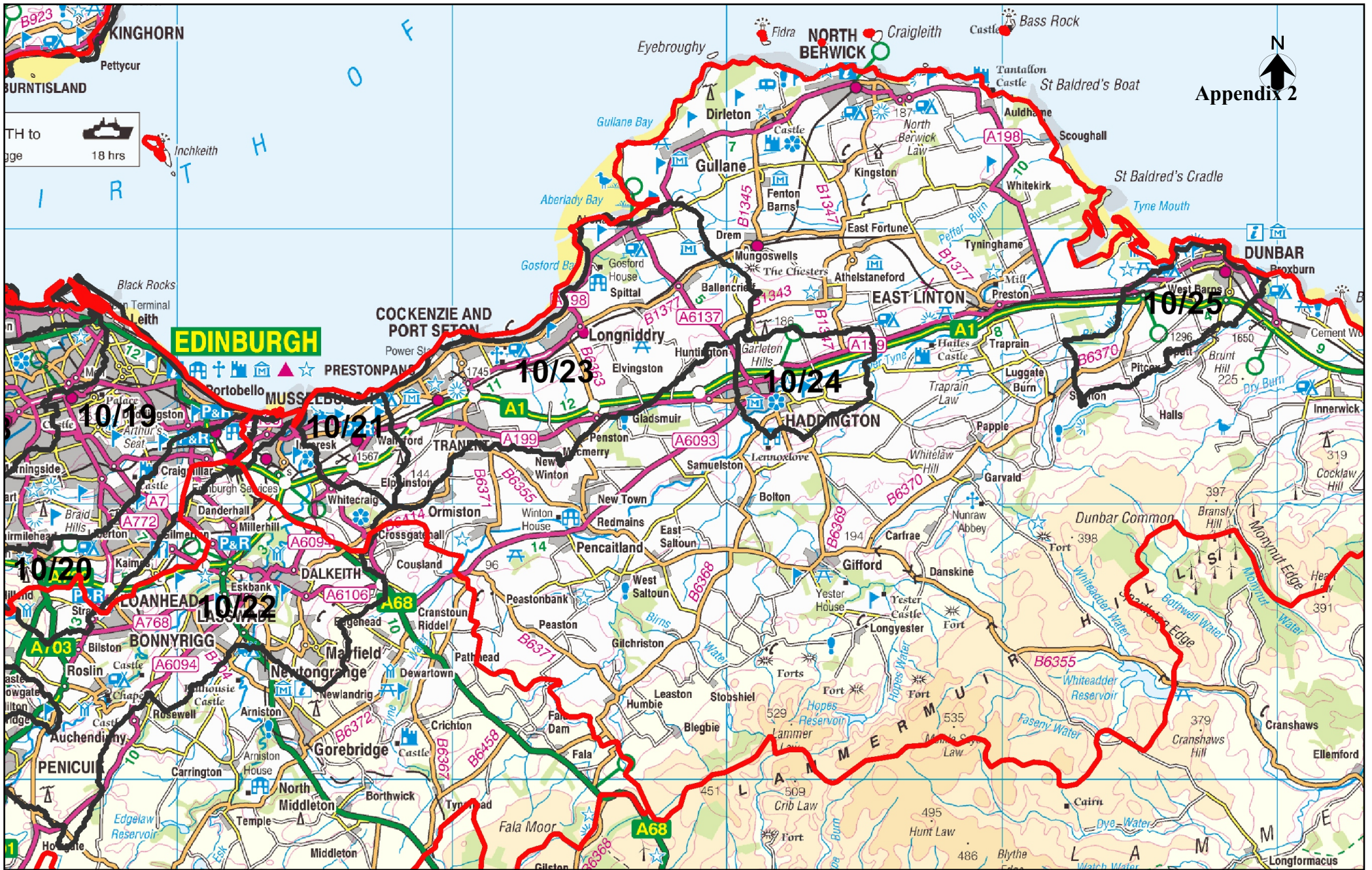
If you have any queries, you can contact the Flood Risk Management Planning team by email: FRMplanning@sepa.org.uk

Figure 3: Key dates in the production of Flood Risk Management Strategies and Local Flood Risk Management Plans



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SECTION 3:

MAIN CATCHMENTS AND COASTAL AREAS WITHIN FORTH ESTUARY LOCAL PLAN DISTRICT

CHAPTER 4.x: COASTAL FLOODING

The Forth Estuary Local Plan District has 375km of coastline stretching from Fife Ness in the north to the Scottish Borders in the South. The coastline includes the Firth of Forth and areas of coast exposed to the North Sea. Several urban areas are situated along the coastline including Grangemouth, Bo'ness, Edinburgh, Musselburgh, North Berwick and Eyemouth. 20 PVAs in the LPD have a risk of coastal flooding (Figure 1).

Within the LPD approximately 2,000 residential properties and 440 non-residential properties are at risk of coastal flooding during the 1 in 200 year event. This represents approximately 1 in 320 homes and 1 in 130 businesses. The total Annual Average Damages caused by coastal flooding in the LPD are approximately £5,000,000. It is estimated that 98% of residential and non-residential properties at risk of coastal flooding in the 1 in 200 year event are location within the PVAs.

The information on coastal flooding in this report is based on SEPA modelling that uses still water level projections. The modelling does not take into account all structures that may reduce the risk of coastal flooding, nor does it take into account the impact of wave overtopping or the interactions between river and coastal flooding. As these factors can often have a large influence on coastal flooding this should be taken into account when interpreting the information contained in this report.

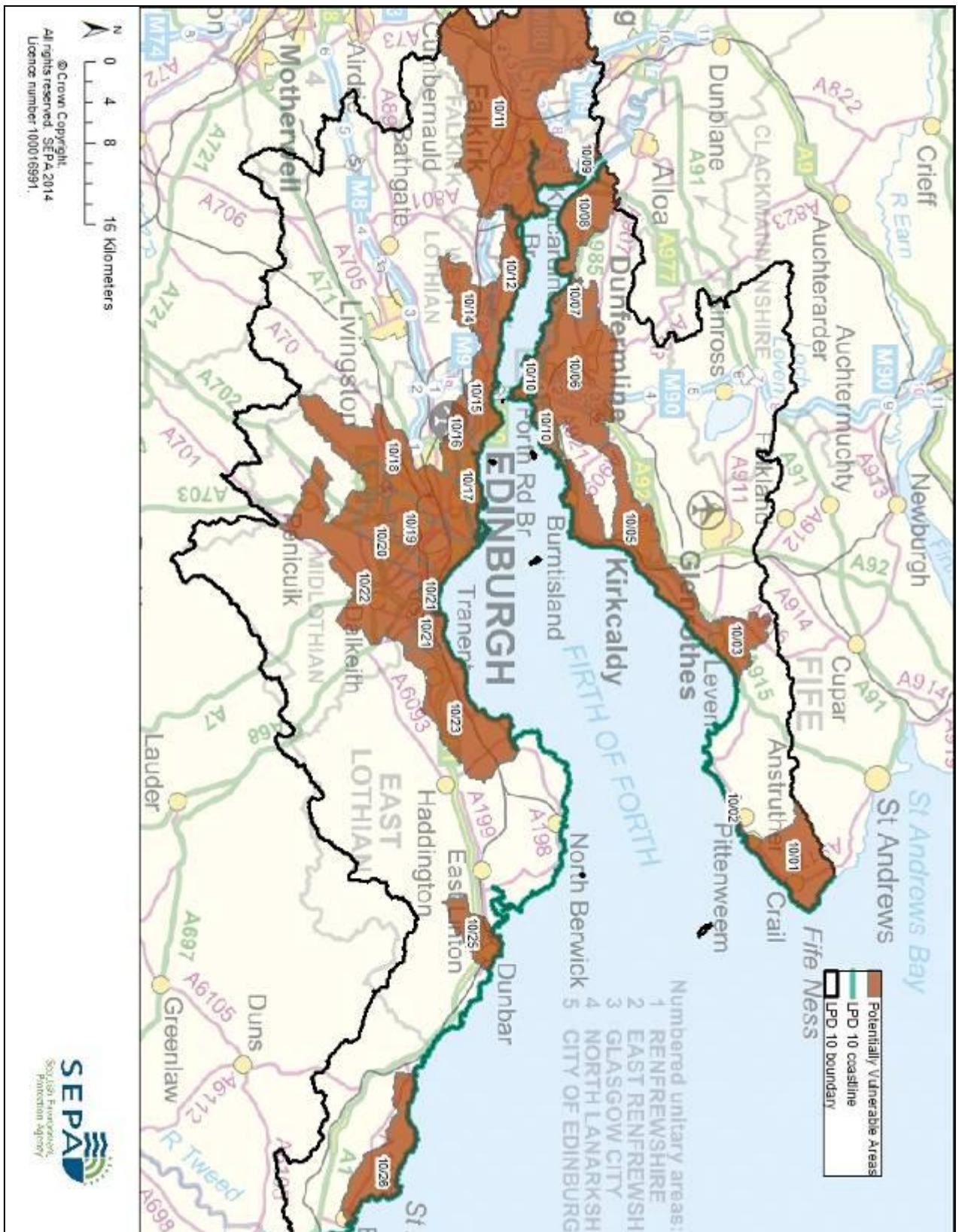


Figure 1 – Map of coastal area and PVAs with a risk of coastal flooding

Main urban centres and infrastructure at risk

The main urban areas with a risk of coastal flooding can be seen in Table 1. Table 1 shows the number of residential properties at risk and the total annual average damages caused by coastal flooding, which includes damages to residential properties, non-residential properties, transport and agriculture. Figure 2 shows the number of residential properties at risk of coastal flooding throughout the LPD.

Table 1 – Main urban areas with a risk of coastal flooding

Locations	No of residential properties at flood risk (at the 1 in 200 year flood event)	Total Annual Average Damages
Grangemouth	670	£1,600,000
Airth	110	£670,000
Musselburgh	380	£660,000
Kincardine	150	£350,000
Culross	130	£320,000
Eyemouth	30	£200,000
Carron-Carronshore	<10	£110,000
Bo'ness	60	£110,000
Edinburgh	40	£100,000
Inverkeithing – North Queensferry	20	£42,000
Dunbar	<10	£26,000
Anstruther - Pittenweem	<10	£22,000
Prestonpans, Cockenzie & Port Seton	<10	£20,000
Queensferry	10	£20,000
North Berwick	20	£13,000
Limekilns	<10	£6,000

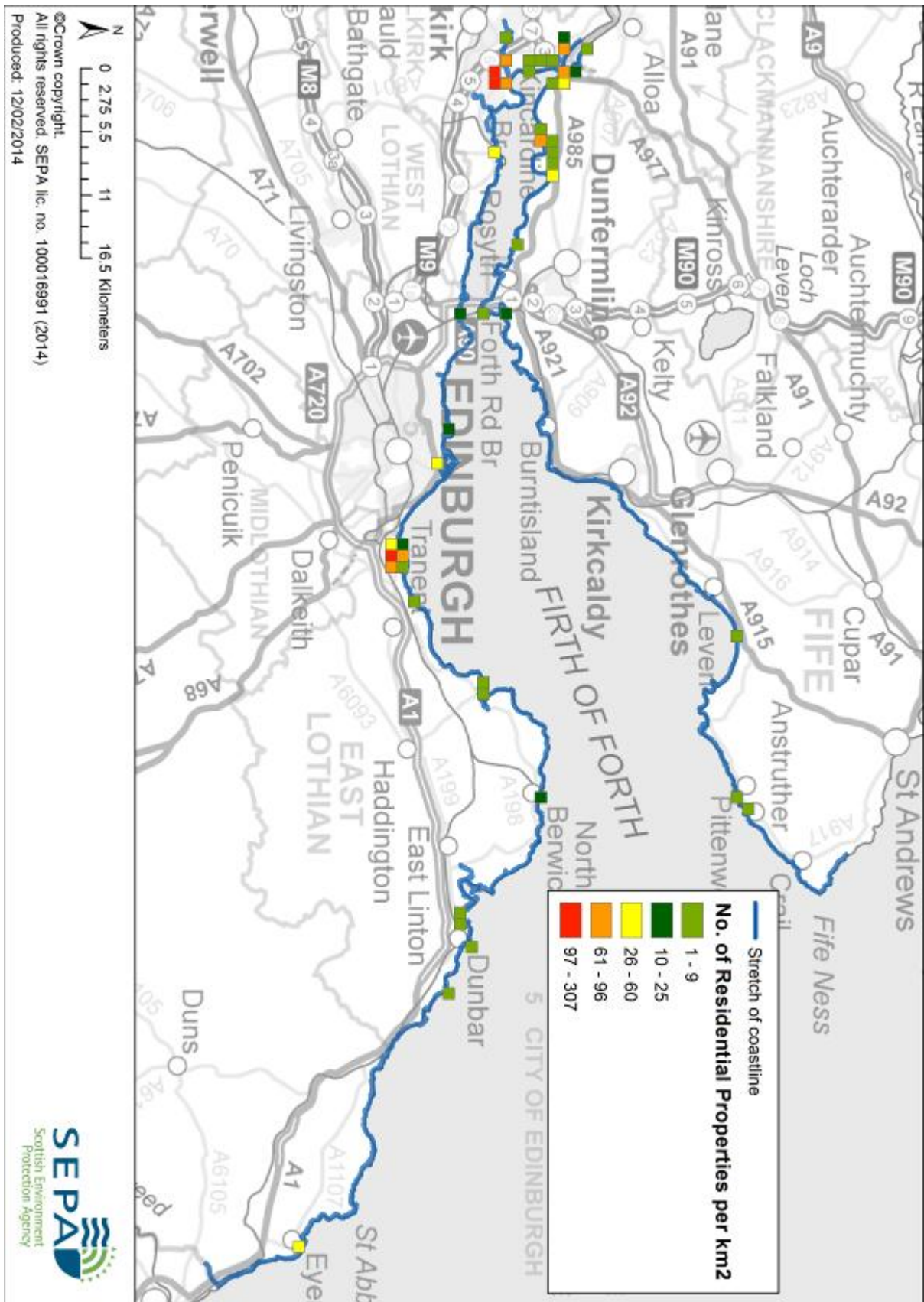


Figure 2 – Residential properties with a risk from coastal flooding during the 1 in 200 year event

Within the LPD approximately 70 infrastructure assets are at risk from coastal flooding during the in 200 year event. This consists of:

- Utility Assets
 - 40 energy production sites
- Community Facilities
 - <10 schools
 - <10 care facilities
- Transport Routes (approximately 31% of total infrastructure assets at risk)
 - 20 Roads (15 A roads affected at 51 locations, 5 B roads affected at 30 locations)
 - 1 Railway routes (Fife circle, Dalmeny to Winchburgh and Haymarket West Junctions affected at 3 locations)

History of Flooding

The following coastal flooding events have been identified as significant:

- 04 January 2014 – A tidal surge combined with a storm surge affected coastal areas across the East of Scotland, particularly around the Forth Estuary. SEPA issued flood alerts from Tayport to Eyemouth.
- 5th December 2013 - A 1.0m North Sea surge combined with a high spring tide of 5.4m caused flooding along the East Coast and in particular Eyemouth was affected. Almost all of Harbour Road in Eyemouth was inundated. Approximately 10 properties were flooded, less than may have been expected as a result of Council and property owner preventative action.
- 15 December 2012 - A combination of wind and high tides caused large waves and coastal flooding along the East coast of Scotland, in the Forth Estuary LPD there was significant damage to North Berwick Harbour and damage to the communal slipway at Dunbar Harbour.
- 30 / 31st March 2010 – A tidal surge coinciding with the highest mean tides of the year caused extensive flooding along the East Coast of Scotland, with the Firth of Forth being one of the worst affected areas. Locations within this coastal area affected included Leith, Musselburgh, Prestonpans, Port Seton, Dunbar, Eyemouth and North Berwick. Impacts included flooding of properties, damage to harbours, seawalls and roads with Edinburgh City Council estimating the cost to repair damages in the region of £650,000.
- 30 March 2010 – The Mercat and Acorn Pets, Kirkcaldy closed after flooding to Esplanade Road.
- 14th October 2010 Musselburgh - flooding from wave overtopping from the sea occurred at the Promenade, Musselburgh and the picnic areas at White Sands Dunbar. Minor erosion to the coastal walkway at Prestonlinks, Prestonpans also occurred.
- 22 October 2002 – A storm caused combined fluvial and coastal flooding in Eyemouth. Impacts included flooding of properties in Harbour Road and the High Street. Sea levels at Eyemouth were at 3.128m
- 18^h March 1969 - 2 boats sunk in Kirkcaldy harbour and esplanade flooded under 2 feet of water. Transport services interrupted
- 30 September 1959 – Grangemouth Docks flooded with highest tides on record at 4.47mAOD
- 04 April 1958 - 40 families evacuated in Kirkcaldy. Homes and businesses flooded, cars washed away and civil infrastructure damaged. Flooding affected other areas along the Fife coastline including Anstruther (Shore Street) and Pittenweem. Portobello Promenade and nearby houses were also flooded during this event
- 01 October 1947– Waves up to 30 feet affected Kirkcaldy with properties and cars damaged from flood waters

- 17 October 1898 – Newhaven Pier, Edinburgh washed away
- 28 November 1897 - at North Berwick it was recorded that sailors drowned with many shipwrecks and damage to boats and roads.
- 1881 – the “Eyemouth Disaster”, 191 fisherman died at Eyemouth
- 1877 – Sea wall washed away between Portobello and Joppa

Economic activity

The total Annual Average Damages (AADs) caused by coastal flooding in the Forth Estuary LPD is approximately £5,000,000. This consists of:

- 65% Residential properties (£2,000,000 direct damages, £1,200,000 indirect damages)
- 26% Non-residential properties (£1,300,000 direct damages)
- 2% Vehicles (£120,000 direct damages)
- 5% Emergency services (£270,000 indirect damages)
- 1% Roads (£50,000 direct damages)
- 1% Agriculture (£25,000 direct damages)

Out of the economic damages assessed the highest damages in the LPD are to residential properties followed by damages to non-residential properties. Figure 3 shows the total AADs throughout the LPD.

High damages are seen around the Grangemouth area due to the large coastal residential settlement and the industrial sites.

High damages are also seen in the Musselburgh area due to the large number of both residential and non-residential properties along the coastline.

High damages seen are identified to be to the industrial units located in and around Rosyth Dockyard, whilst significant damages are identified in Lower Largo and Lundin Links due to the number of residential properties along the coastline.

High damages are seen in Eyemouth due to commercial properties around the Harbour whilst local council and agency buildings also account for large proportions of the economic damages in the Eyemouth area.

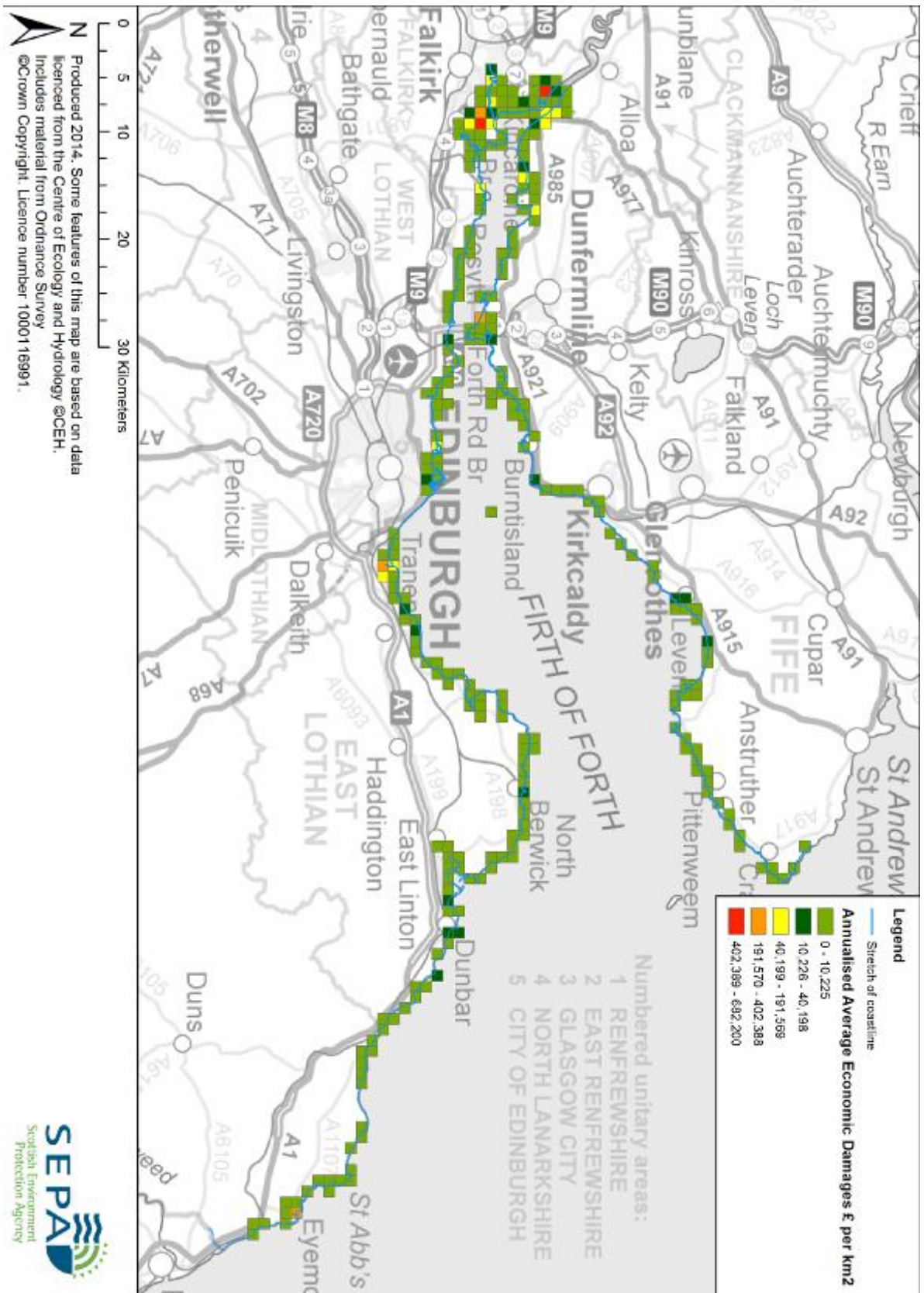


Figure 3 – Annual Average Damages from coastal flooding

Areas of Environmental and Cultural Importance at risk of flooding

Within the LPD approximately 55 cultural heritage sites are at risk of coastal flooding during the 1 in 200 year event. This includes 30 Scheduled Monuments, 20 Gardens and Designated Landscape sites, 4 Battlefield sites and 1 World Heritage Site.

Approximately 12 environmental sites are at risk of coastal flooding during the 1 in 200 year event. This includes; 1 Special Areas of Conservation site, 5 Special Protection Areas and 6 Sites of Special Scientific Interest.

4.x.2 Managing flood risk along the coastline

Existing flood protection schemes

There are 3 coastal flood protection / prevention schemes that were constructed under the Flood Prevention (Scotland) Act 1961 within the LPD:

- Bo'ness: Coastal flood protection scheme, construction was completed in 2011 and has a standard of protection of 1 in 200yr
- Grangemouth: The Grange Burn FPS serves the area of Grangemouth. This is mainly a fluvial protection scheme but also has some coastal protection benefits. It commences at an overflow on the Grange Burn immediately downstream of the M9 Motorway & Beancross Road. It discharges to the River Avon immediately upstream of Wholeflats Road Bridge. It has an unknown standard of protection.
- Prestonpans: The Prestonpans coastal flood protection scheme has a standard of protection of 1 in 200 years.

Other measures exist that were not constructed under the 1961 Act but do reduce the impact of coastal flooding, this may include other structures, natural features and natural flood management measures. These other measures can be seen in the Technical Annex in Table 3.

Existing coastal flood warning schemes

SEPA's Floodline service provides flood alerts and flood warnings throughout Scotland to the public and to organisations that have flooding related duties.

Flood alerts are issued over wide geographical areas (normally matching local authority boundaries). Information is used from the Met Office and SEPA to determine if flooding is possible within the flood alert area.

Where SEPA has a river or coastal flood monitoring system, flood warnings can be issued for a local target area that can more accurately predict the likelihood and timing of flooding.

There are 19 coastal Flood Warning Target Areas within the Forth Estuary LPD, as shown in Table 2 and Figure 4.

Table 2 – Flood Warning Target Areas

Flood Warning Target Area	No. of properties within FWTA	% of properties registered – January 2014
Anstruther to Elie	124	15
Blackness	24	8
Burntisland to Aberdour	26	15

Culross, Longannet & Kincardine	615	9
Dunbar including West Barns	198	30
Eyemouth Coastal	88	20
Grangemouth	1,340	12
Granton and Leith	3,545	7
Kinghorn	50	6
Kirkcaldy	156	7
Leven and Methil	285	9
Lower Largo	38	39
Musselburgh Coastal	2,085	13
North Berwick	48	58
North Queensferry and Inverkeithing Bay	184	15
Portobello Esplanade	162	10
Prestonpans, Cockenzie & Port Seton	297	10
Rosyth, Limekilns and Charlestown	106	13
Torryburn and Newmills	29	10

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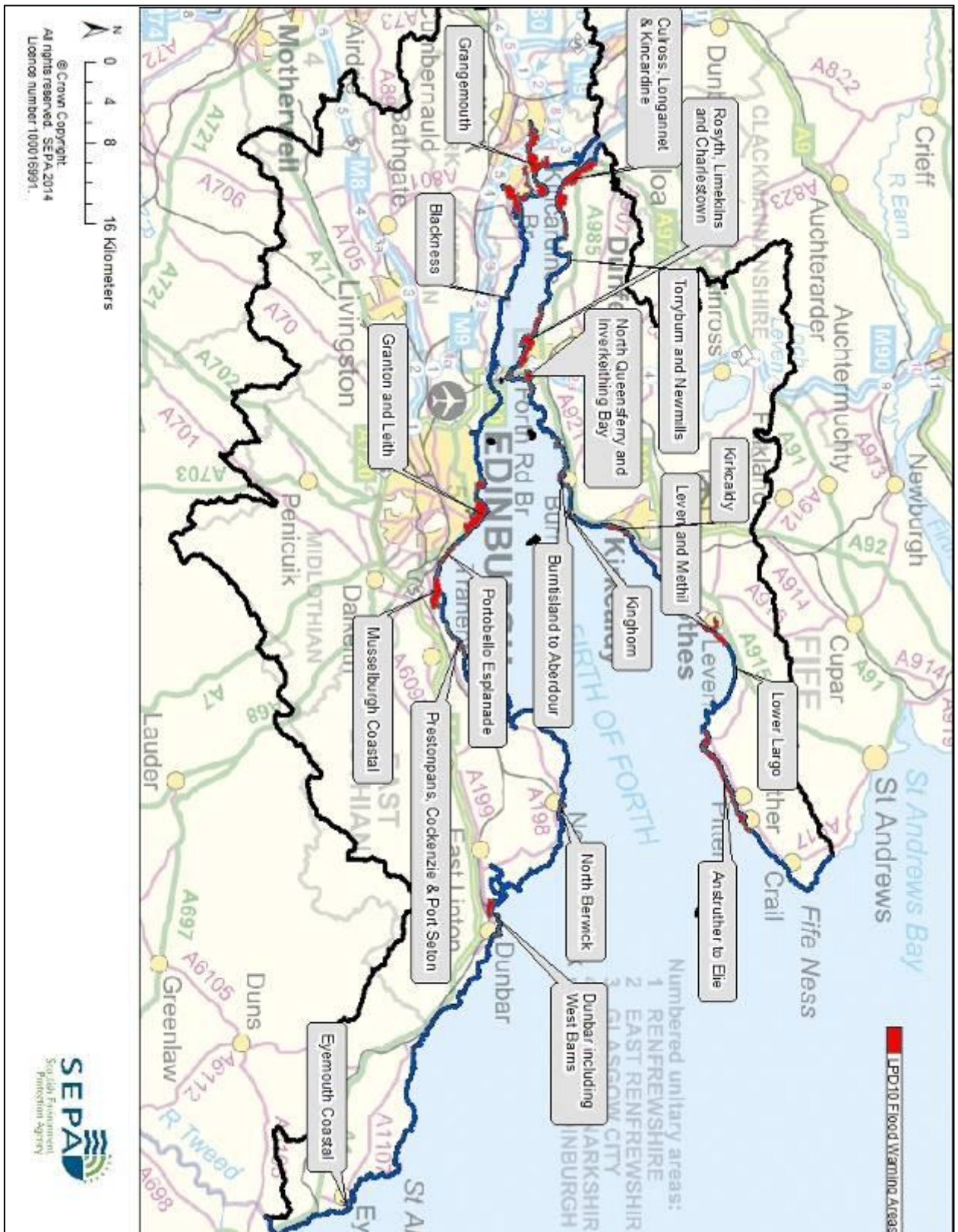


Figure 4 – Map of coastal Flood Warning Target Areas

Awareness raising campaigns & community flood action groups

SEPA and the local authorities work closely with many other organisations that have flooding related duties such as the police, fire & rescue services, the Scottish Government and the Scottish Flood Forum. SEPA and the local authorities, often in partnership with these organisations, undertake various awareness raising campaigns that include community events, information leaflets, educational plays in schools, the use of social media and advertising.

In addition the following community groups that help with flood resilience are known to operate within this LPD:

- Burnmouth Resilient Community Group
- Coastal Regeneration Group for Port Seton and Cockenzie
- Cockburnpath Resilient Community Group.
- Dunbar Shore and Harbour Neighbourhood Group
- East Lothian Bio-diversity Group and Local Community Councils
- Eyemouth Resilient Community Group
- Friends of the River Tyne
- Musselburgh Waterfront Group
- North Berwick Environment Group
- St Abbs Resilient Community Group,

Property level resilience/ resistance measures

Each local authority has their own policies regarding property level protection. Contact your local authority or view their website for more information.

The following incentives or subsidies have been put in place to provide property owners with property level resilience / resistance measures:

- East Lothian Council strategically deploy temporary flood barriers and sand bags when properties are threatened by flooding
- Fife Council provide Aquasacs for use in emergencies and these are available from stores (flood pods) throughout Fife.
- Scottish Borders Council operates a subsidised flood protection products scheme for residential and non-residential property owners in flood risk areas.
- Scottish Borders Council has provided and maintains dedicated sandbag stores in areas of flood risk to ensure sandbags are available to the public in the event of a flood.

Flood Risk Management Studies

The following coastal flood risk management related studies have been identified in the LPD:

- East Lothian Shoreline Management Plan (East Lothian Council)
- Fife Shoreline Management Plan (Fife Council)
- Assessment of the implications of the Firth of Forth ship-to-ship transfer oil spill contingency plan (Maritime and Coastguard Agency)
- Leith Docks to Port Seton Heavily Modified Water Bodies
- Sea defence survey (HR Wallingford, 01-04-1997)
- St Abb's Head to River Tyne Shoreline Management Plan (Posford Divvier – September 1998)

- Portobello Beach - review of past performance and options for improvement (HR Wallingford, 01-11-2002)
- Granton waterfront, Wave and water level conditions report (HR Wallingford, 01-12-2002)
- Coastal defence survey, East Lothian Shoreline Management Plan (2002).
- Causes of beach lowering at Dunbar, Eastern Scotland, UK, Maritime Engineering 01/2006;59(MA4):157-166 (Pontee, 2006)
- Grangemouth (Sir Frederick Snow and Partners, 2006)
- Portobello seawall Standard of flood protection study , (HR Wallingford, 04-05-2007)
- Eyemouth Seawall – Inspection, Testing and Options Report (Royal Haskoning – August 2009)
- Asset Management Plan (Edinburgh), Jacobs, 2009
- Grangemouth Flood Study (2011 & 2012, Halcrow Group Ltd)
- SEPA (2012) Coastal Flood Warning Improvement Project Phase 3: Firth of Forth and Tay 7th December 2012 (Royal Haskoning)
- Review of coastal flooding documents (City of Edinburgh Council , 05-01-2013)
- Eyemouth Overtopping and Flood Study (Royal Haskoning – March 2013)

Although not specifically relating to coastal flooding, the following documentation may contain relevant information relating to coastal flood management:

- Water of Leith FPS modelling (model includes Fluvial and Coastal interface at Leith)
- Musselburgh Flood Study (Jacobs)

4.x.3 Climate Change and future flood risk

UK Climate Projections (UKCP09) predicts future climate change may lead to increased sea levels. The predicted magnitude of sea level rise due to climate change varies around the coastline based on UKCP09 2080 horizon projections. Coastal flooding has been modelled as a still water level projection, without wave action; therefore there has been no consideration of the impacts of future climate on wave overtopping or storminess which could increase the number of people affected by coastal flooding.

The predicted average increase around the Forth Estuary LPD ranges from 0.47m – 0.5m by 2080. Within the Forth Estuary LPD it is estimated that the 1 in 200 year plus climate change scenario will increase the number of residential properties at risk of coastal flooding from approximately 2,000 to approximately 10,000 and the number of non-residential properties from approximately 440 to approximately 1,400. This represents a change of 400% and 220% respectively.

The predicted average sea level increases, and the predicted increases in coastal flood risk around the coastal line are outlined below:

North Queensferry to Fife Ness

The predicted average sea level increase is 0.49m by 2080.

The 1 in 200 year plus climate change scenario may increase the number of residential properties at risk of coastal flooding from approximately 30 to approximately 140 and the number of non-residential properties from approximately 40 to approximately 1,700. This represents a change of 390% and 270% respectively, with the urban centres of Kirkcaldy and Buckhaven-Methil-Leven now affected by coastal flooding.

Mid Firth of Forth (North and South coast of mid Firth of Forth from Clackmannanshire Bridge to North and South Queensferry)

The predicted average sea level increase is 0.47m by 2080.

The 1 in 200 year plus climate change scenario may increase the number of residential properties at risk of coastal flooding from approximately 1,100 to approximately 8,000 and the number of non-residential properties from approximately 150 to approximately 700. This represents a change of 630% and 370% respectively with the urban centre of Falkirk now affected by coastal flooding.

South Queensferry to North Berwick

The predicted average sea level increase is 0.49m by 2080.

The 1 in 200 year plus climate change scenario may increase the number of residential properties at risk of coastal flooding from approximately 480 to approximately 2,200 and the number of non-residential properties from approximately 100 to approximately 440. This represents a change of 350% and 340% respectively. The largest increases in properties at risk will be seen in Edinburgh and Musselburgh with the urban centre of Cockenzie and Port Seton also being affected by coastal flooding.

North Berwick to English Border

The predicted average sea level increase is 0.50m by 2080.

The 1 in 200 year plus climate change scenario may increase the number of residential properties at risk of coastal flooding from approximately 50 properties to approximately 100 properties and the number of non-residential properties from approximately 45 properties to approximately 70 properties. This represents a change of 100% and 50% respectively.

4.x.4 Coastal processes

The Forth Estuary Local Plan District has 375km of coastline stretching from Fife Ness in the north to the Scottish Borders in the South. The coastline includes the Firth of Forth and the coastline from North Berwick to the English border exposed to the North Sea.

The Firth of Forth is the largest estuary on the East Coast of Scotland and extends 95km from Stirling in the West, where the River Forth flows into estuary, to Fife Ness in the East where it meets the North Sea. The Forth Estuary LPD includes the mid and outer Firth of Forth, the inner Firth of Forth (from Stirling to Dunmore) is included in the Forth LPD.

The main influences of coastal flooding in the Firth of Forth are storm surges and locally generated winds, due to the sheltering effects of the estuary the Firth of Forth is less affected by swell waves but the influence of these increases towards the outer Firth of Forth.

The coast from around North Berwick to the Scottish Border is out with the Firth of Forth and is exposed to the North Sea. In this area storm surges, swell waves and locally generated waves all influence coastal flooding.

Sediments in the inner Firth of Forth are generally characterised by finer sediments and mud, creating habitats such as mudflats, salt marshes and reed beds, these habitats can be seen at Skinflats North of Grangemouth and the Alloa Inches. Over the last two hundred years, much of the mudflat areas of the inner and mid Firth of Forth have been drained and lost to agricultural or filled in for industry. Toward the outer Firth of Forth the sediments in the estuary become coarser creating habitats such as sandy beaches and dunes e.g. at Gullane Bay and Aberlady Bay.

SEPA have undertaken an assessment of the natural susceptibility to coastal erosion, it gives a high level indication of the natural susceptibility to erosion around the coastline and does not take into account the presence of any structures that might be in place to manage coastal erosion. Maps of the natural susceptibility to coastal erosion can be seen in the Technical Annex in figures A1.1 – A1.10, and maps of structures that help to manage

coastal erosion can be seen in the Technical annex in figures A2.11 – A2.11 (please note that these maps do not include all existing structures). The findings of this assessment indicate:

Most of the coastline along North Queensferry to Fife Ness has a low susceptibility to coastal erosion. However, Burntisland and Methil are considered to be more susceptible to coastal erosion. Although the areas around Burntisland, Kirkcaldy and Methil are shown to be naturally slightly more susceptible to coastal erosion, there are a number of structures that help manage coastal erosion present that mostly coincide with the urban areas of Kirkcaldy, Burntisland, Inverkeithing, Methil, Buckhaven and Anstruther, (Figure A1.2.x and Figure A2.2.x in the Technical Annex).

Most of the coastline around the mid Firth of Forth has a medium and medium to high susceptibility to coastal erosion. Areas including to the West of Grangemouth, Bo'ness and Kincardine are particularly susceptible to coastal erosion. Although the areas around Grangemouth, Bo'ness and North Queensferry are shown to be naturally slightly more susceptible to coastal erosion, structures that help manage coastal erosion are present along much of the coastline, (Figures A1.5. A2.5.) in the Technical Annex).

Most of the coastline along South Queensferry to North Berwick has a medium susceptibility to coastal erosion, however, there are isolated areas, notably between Leith and Portobello that are more susceptible to coastal erosion. Although the area around Edinburgh is shown to be naturally slightly more susceptible to coastal erosion, structures that help manage coastal erosion are present particularly between Cramond and Prestonpans, (see, Figure A1.7 and Figure A2.7 in the Technical Annex).

Most of the coastline along North Berwick to the English Border has a low to medium susceptibility to coastal erosion with areas including the coastline between Dunbar and Thorntonloch noted as being particularly susceptible to coastal erosion. Although the areas around Dunbar, St Abb's and Burnmouth are shown to be naturally more susceptible to coastal erosion, structures that help manage coastal erosion are present in the West Barns area of Dunbar, at the Torness Nuclear Power Station, at St Abb's and at Burnmouth, (Figure A1..10x and A2.11 in the Technical Annex).

4.x.5 Potential for Natural Flood Management

Natural Flood Management (NFM) refers to the restoration, enhancement or alteration of natural features and characteristics. This assessment provides a high level strategic assessment of those areas where the implementation of certain types of NFM measures would be most effective and where further investigation may be merited.

Two types of natural flood management measures have been considered for coastal flooding; estuarine surge attenuation and wave energy dissipation. The maps showing potential for natural flood management can be seen in the Technical Annex (Figures A3.1-A3.5 show the potential for estuarine surge attenuation, Figures A4.1-A4.11 show the potential for wave energy dissipation).

The findings of the assessment indicate:

There is potential for the attenuation of estuarine surge (to reduce impacts of coastal surges) to be used to reduce flood risk in and around Kincardine and Rosyth (see figure A3.2 & A3.3).

Figures A3.1 and A3.2 in the Technical Annex show that there is a medium potential for estuarine surge attenuation (to reduce impacts of coastal surges) which could provide flood

risk benefits along much of the mid Firth of Forth, particularly around parts of Grangemouth, Bo-ness and Queensferry. As shown in Figures A4.1 and A4.2 there appears to be a greater potential for wave dissipation (opportunities to reduce erosion through reducing wave power), which could provide possible flood risk benefits, particularly around Grangemouth and Queensferry, with lesser (but still medium) potential at Bo-ness. The feasibility of implementing any NFM schemes may however be limited due to the large amount of industry along this coastline.

Figure A3.x in the Technical Annex shows there is limited to no potential for estuarine surge attenuation (reduce impacts of coastal surges) to provide flood risk benefits along North Berwick to English Border, however, Figures A4.1 to A4.3 (see Technical Annex) illustrate that there may be potential for wave dissipation (opportunities to reduce erosion through reducing wave power) to provide flood risk benefits, particularly around Dunbar and within PVA 10/26.

Figure A3.x in the Technical Annex shows that there is medium to high potential for estuarine surge attenuation (reduce impacts of coastal surges) to provide flood risk benefits to the west of Edinburgh at Queensferry. There is also high potential for wave dissipation (opportunities to reduce erosion through reducing wave power) to provide flood risk benefits along most of the South Queensferry to North Berwick coastline (shown in Figure A4.x in the Technical Annex).

Figure A3.x in the Technical Annex shows that whilst the potential for estuarine surge attenuation (reduce impacts of coastal surges) to provide flood risk benefits along the North Queensferry to Fife Ness coastline is limited, there is potential for benefits around North Queensferry and Inverkeithing. The potential for wave dissipation (opportunities to reduce erosion through reducing wave power) to provide flood risk benefits is more widespread with medium to high potential along most of the coastline (shown in Figure A4.x in the Technical Annex).

4.x.6 Links with River Basin Planning

North Queensferry to Fifeness

There are 3 coastal and no estuarine water bodies defined under the Water Framework Directive in this area. The ecological status of the physical condition of beds and shores for all of these is good or better. This means any opportunities to improve the physical condition of the shoreline that could also reduce flood risk would not improve the overall ecological status. However, SEPA recognise there are gaps in our understanding of the physical condition of the shoreline and current classification may underestimate these impacts.

Alterations to the physical condition of the shoreline identified as pressures include approximately 8.6km of shoreline protection structures. Approximately 1.40km² of land has also been reclaimed from the sea for ports and harbours. These areas could be providing important protection functions or provide opportunities for natural flood management to improve the physical condition of the shoreline and reduce flood risk.

Port Edgar to North Queensferry

There are no coastal and 3 estuarine water body defined under the Water Framework Directive in this area. The Middle Forth Estuary water body is at moderate ecological status due to the physical condition of the beds and shores. This is not heavily modified which means there are still opportunities to improve the physical condition of the shoreline. These

could also provide opportunities to reduce flood risk. The other 2 water bodies are all at good or better ecological status. This means any opportunities to improve the physical condition of the shoreline that could also reduce flood risk would not improve the overall ecological status. However, SEPA recognise there are gaps in our understanding of the physical condition of the shoreline and current classification may underestimate these impacts.

Alterations to the physical condition of the shoreline identified as pressures include approximately 1.6km of flood protection embankments and 9.4km of shoreline protection structures. Approximately 15.40km² of land has also been reclaimed from the sea, with 36.0% for agricultural use. These areas could be providing important protection functions or provide opportunities for natural flood management to improve the physical condition of the shoreline and reduce flood risk.

Inner Forth Estuary

This coastal area is located within the Upper Forth Estuary water body. The physical condition of the beds and shores is at poor ecological status, but it is not designated as heavily modified. This means there are opportunities to improve the physical condition of the shoreline. These could also provide opportunities to reduce flood risk.

Alterations to the physical condition of the shoreline identified as pressures include approximately 3.2km of shoreline protection structures. Approximately 5.30km² of land has also been reclaimed from the sea, with 101.0% for agricultural use. These areas could be providing important protection functions or provide opportunities for natural flood management to improve the physical condition of the shoreline and reduce flood risk.

Examples of projects being undertaken to improve ecological status that potentially relate to flood risk management include the Tidal exchange and Skinflats, Black Devon Wetland and the realignment of the Kincardine power station

North Berwick to Port Edgar

There are 4 coastal and 1 estuarine water bodies defined under the Water Framework Directive in this area. The Leith Docks to Port Seton water body is at moderate ecological status due to the physical condition of the beds and shores. This is designated as heavily modified because changes required to return the physical condition to good ecological status would impact significantly on sustainable developments including flood protection. However, it is not at good ecological potential which means there are still opportunities to improve the physical condition of the shoreline. These could also provide opportunities to reduce flood risk. The other 4 water bodies are all at good or better ecological status. This means any opportunities to improve the physical condition of the shoreline that could also reduce flood risk would not improve the overall ecological status. However, SEPA recognise there are gaps in our understanding of the physical condition of the shoreline and current classification may underestimate these impacts.

Alterations to the physical condition of the shoreline identified as pressures include approximately 16.3km of shoreline protection structures. Approximately 4.00km² of land has also been reclaimed from the sea for industrial land use and ports and harbours. These areas could be providing important protection functions or provide opportunities for natural flood management to improve the physical condition of the shoreline and reduce flood risk.

Border to North Berwick

There are 3 coastal and 1 estuarine water bodies defined under the Water Framework Directive in this area. The ecological status of the physical condition of beds and shores for all of these is good or better. This means any opportunities to improve the physical condition

of the shoreline that could also reduce flood risk would not improve the overall ecological status. However, SEPA recognise there are gaps in our understanding of the physical condition of the shoreline and current classification may underestimate these impacts.

Alterations to the physical condition of the shoreline identified as pressures include approximately 2.4km of flood protection embankments and 1.9km of shoreline protection structures. These areas could be providing important protection functions or provide opportunities for natural flood management to improve the physical condition of the shoreline and reduce flood risk.

Further information on the current ecological status of coastal waters and targets to improve these can be viewed on SEPA's website: [\[link to spotfire page\]](#). SEPA is consulting on the second river basin management plans until May 2015. This includes proposals for heavily modified water body designations and how targeting improvements to the physical condition of water bodies should be prioritised.

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