01 Golspie Coast Flood Protection Study
Sgrùdadh Dìon Thuiltean Cladach Ghoillspidh

Welcome to the public consultation event for the Golspie Coast Flood Protection Study. The purpose of the event is to inform you of the work we've been doing, outline the long list of options being considered and to gather your feedback. This will ensure the study takes everything into account and identifies an appropriate way to manage coastal flood risk in Golspie and along the coastline.

Why are we here?

In 2011, SEPA produced the National Flood Risk Assessment which investigated all sources of flooding as well as the likely impact of climate change. The assessment identified that Golspie was potentially at risk of coastal flooding and further investigation was required.

At this point we want to present you with the baseline flood risk findings and suggest some of the options available to mitigate flood risk. Your views will help us identify an appropriate way to manage coastal risks along the Golspie coastline.

What are the aims of this event?

- To describe the nature of the coastal flooding;
- To present the baseline flood risk findings;
- To show you some of the potential options that could be implemented to reduce flood risk;
- To explain the next steps in the process.

Work to date has consisted of the following:

- Coastal modelling to calculate wave climate and extreme sea levels;
- Hydraulic modelling to calculate wave overtopping flood inundation;
- Topographical surveys of the study area;
- Stakeholder meeting with statutory bodies;
- Environmental survey.

How can you provide your feedback?

A questionnaire is available for you to leave your comments.

Please browse through the information provided on the display posters. Our team is here to answer any questions you may have.

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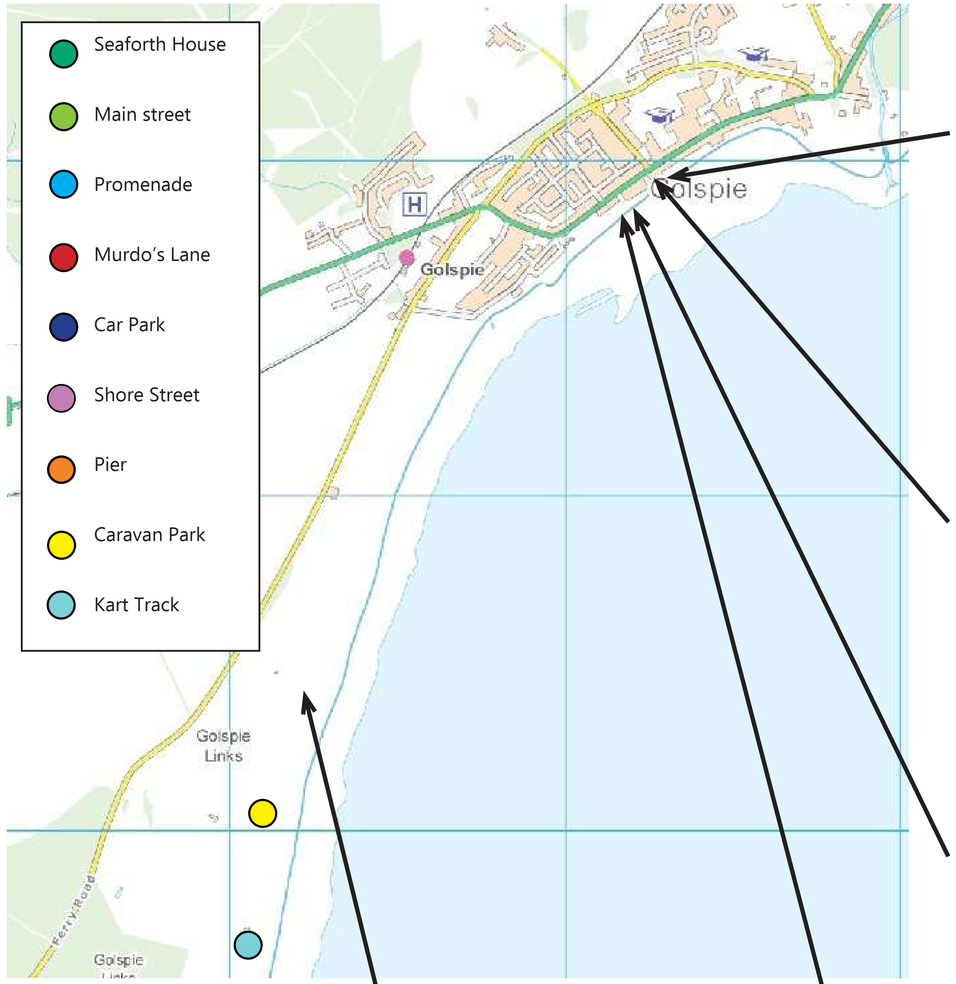
02 Historic Flooding

There is a history of coastal flooding in Golspie despite the various defences which are in place.

- **December 2012:** Coastal storms caused damage in the town and led to overtopping of the embankments at the Golf Course and Caravan Park.

- **February 2014:** Coastal flooding of Promenade in Golspie.

- **October 2014:** Coastal flooding caused damage in Golspie and in particular at the Caravan Park and Golf Course.



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03 What is the scale of the flood risk?

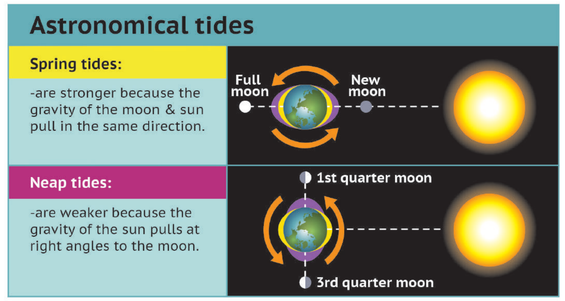
Defining the coastal flood risk

Flood risk is defined in terms of return period. The return period is the average time period between occurrences of conditions of the same magnitude. For example a 1 in 100 year return period sea level will have a 1 in 100, or 1% chance of happening in any given year.

We have used computer modelling to estimate the likelihood of flooding in Golspie from high sea levels and wave carryover. High sea level describes the still water level of a given return period. Wave carryover refers to the rate of flow landwards as a result of waves breaking over a defence.

We carried out wave modelling to assess potential high sea levels and quantify the wave carryover along the Golspie coastline. This information was then applied to a flood inundation model which contained features such as the topography and coastal defences. The modelling output allowed us to see which areas may be at risk, giving us a best estimate of flood extent, depth and velocity for a range of return periods.

A sensitivity analysis was undertaken by changing the model parameters and assessing their effect on the results. This improved our confidence in the model.



Extract from SEPA NFM Handbook - Coastal Flooding Mechanisms

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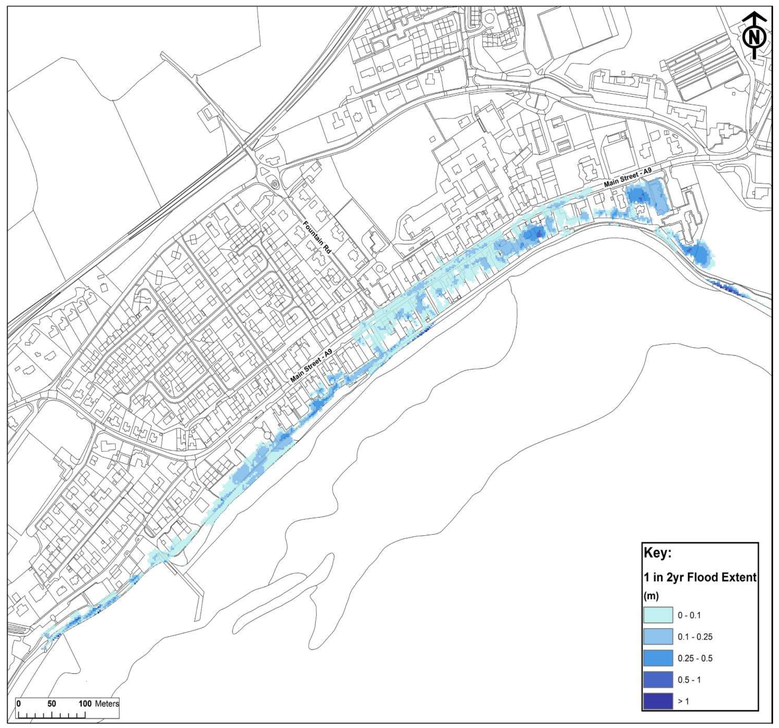
04 What is the scale of the flood risk in Golspie Town?

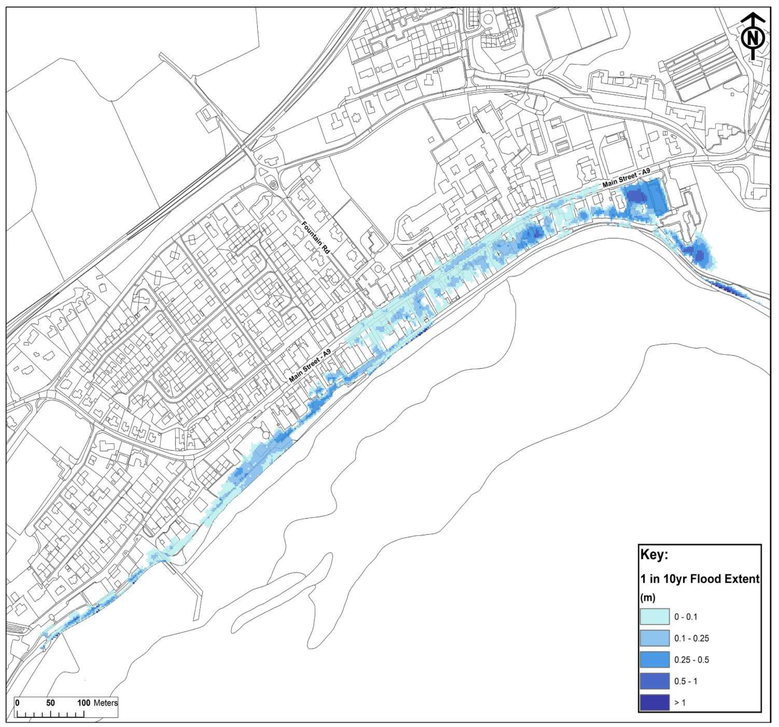
The model predicts wave overtopping in the town will first occur along the Promenade. The majority of this flow is deflected back out to sea by the existing storm walls at the back of the Promenade and only a small portion continues towards Main Street. This flow travels down the ungated alleyways, under floodgates, through gardens and in-between properties. Floodwater will pond in the low lying sections of Main Street and Seaforth House, as well as the gardens and properties adjacent to the Promenade.

Wave overtopping at Shore Street affects areas of the car park, open land to the west of the car park and Murdo's Lane. Overtopping flows in an easterly direction down Murdo's Lane, spilling into gardens at openings in the wall. The overtopping at the Pier is limited to a small area of open space around Shore Street.

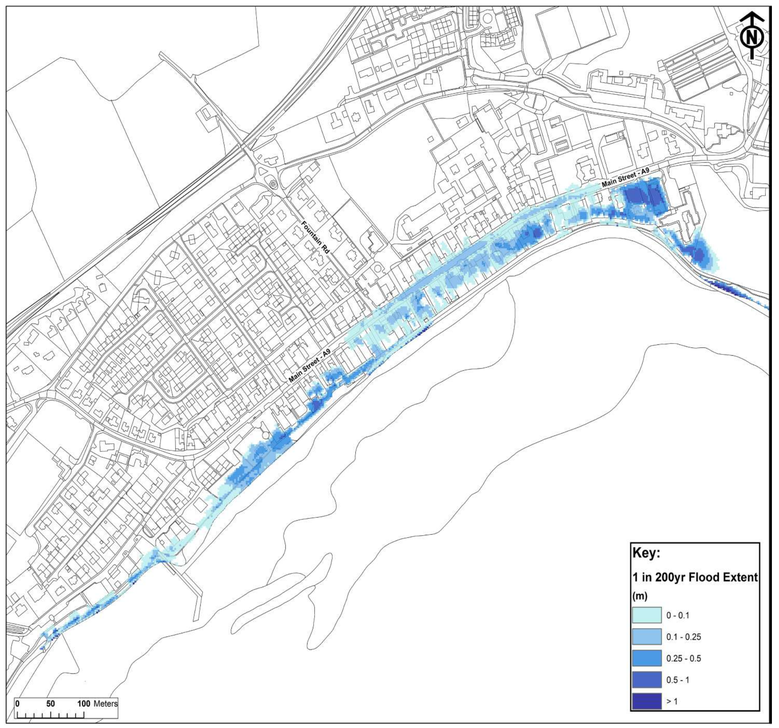
We would like to hear your opinion on the predicted flooding extents produced by the hydraulic model and whether this reflects the flooding you have experienced in Golspie.



Predicted 1 in 2yr Flood Extent Map



Predicted 1 in 10yr Flood Extent Map



Predicted 1 in 200yr Flood Extent Map

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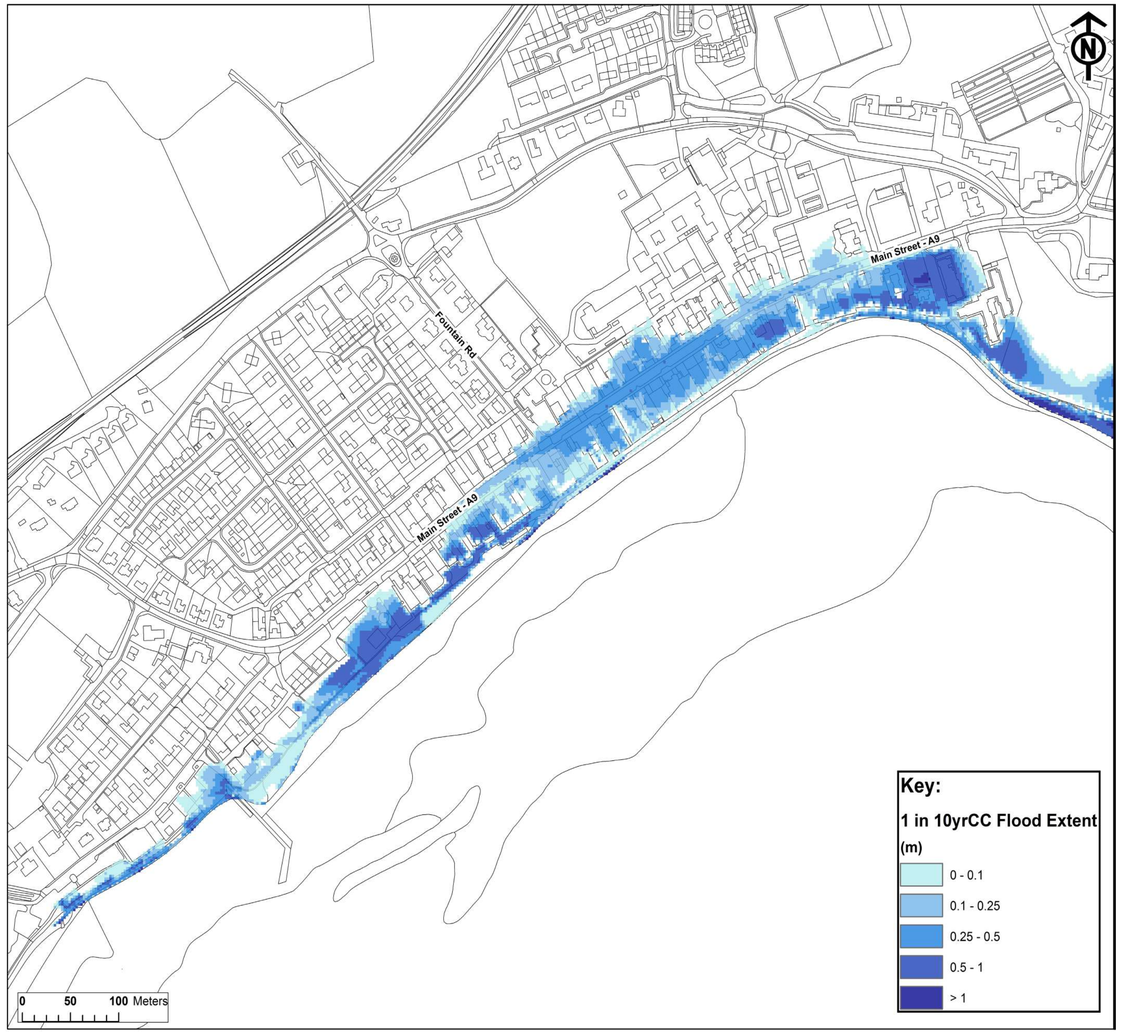
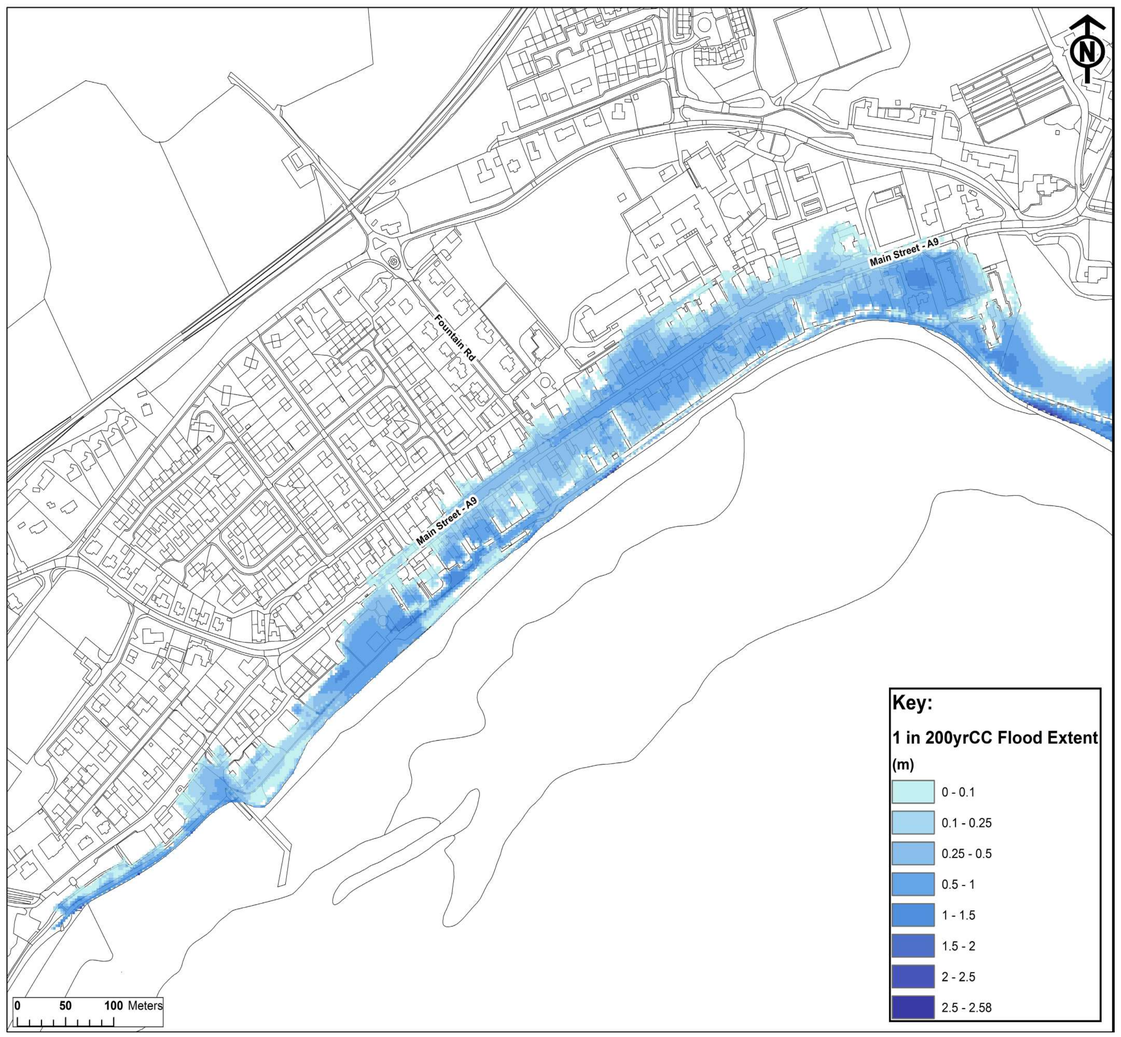
05 What is the scale of the flood risk in Golspie Town?

Climate change projections on sea levels and wave conditions over the next 100 years have been assessed. Results of the climate change scenario show that the extent and depths of flooding is increased when compared to the event without climate change.



Predicted 1 in 10yr Flood Extent map with Climate Change in 100 years



Predicted 1 in 200yr Flood Extent map with Climate Change in 100 years

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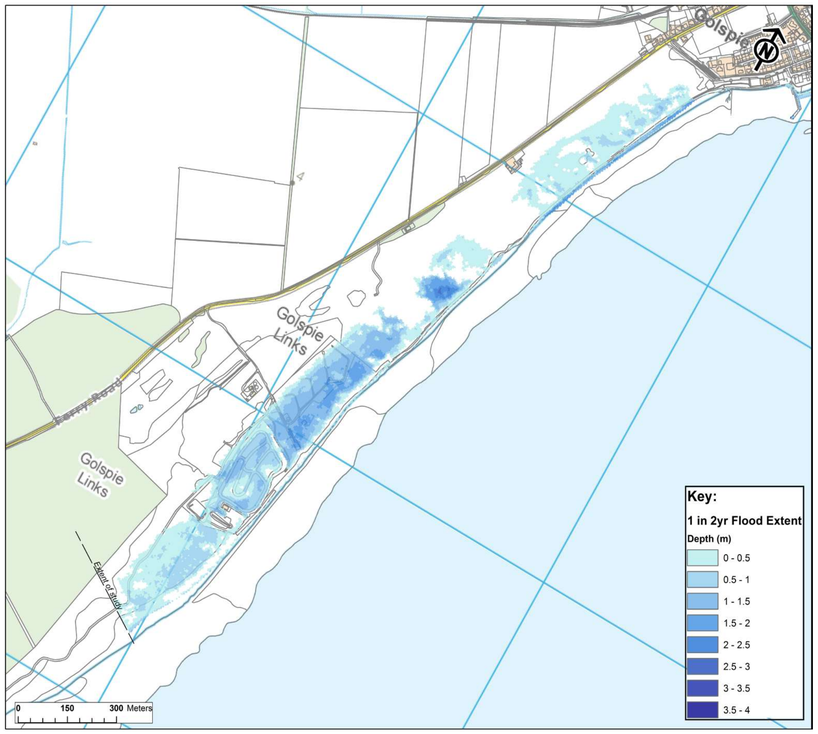
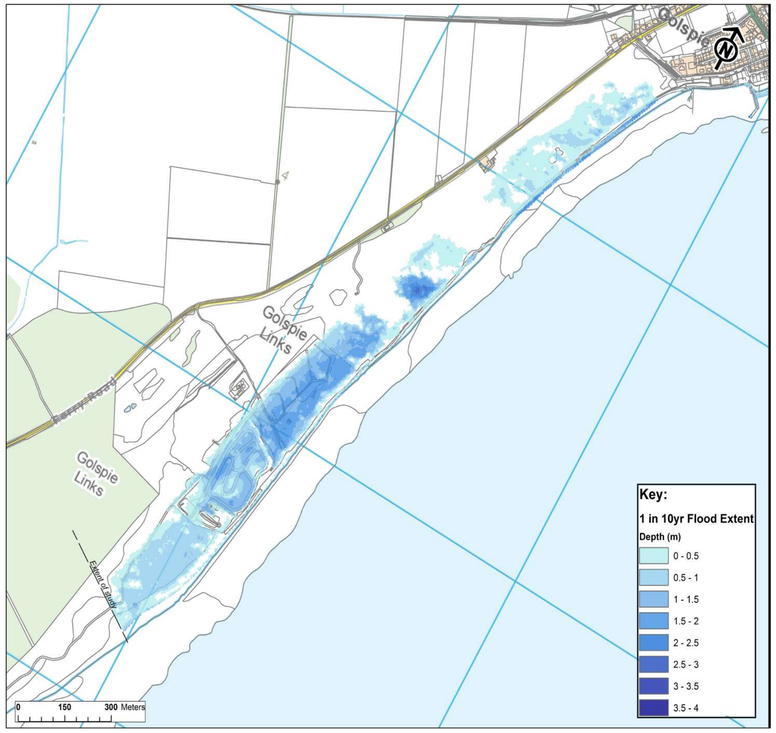
06 What is the scale of the flood risk in Golspie Links?

The model predicts the first instance of flooding occurs due to waves overtopping the coastal embankment at the northern and southern ends of the Golf Course, and at the Kart Track. Overtopping flooding occurs along the remainder of the coastline shortly afterwards, with the exception of a more elevated stretch in the middle portion of the Golf Course.

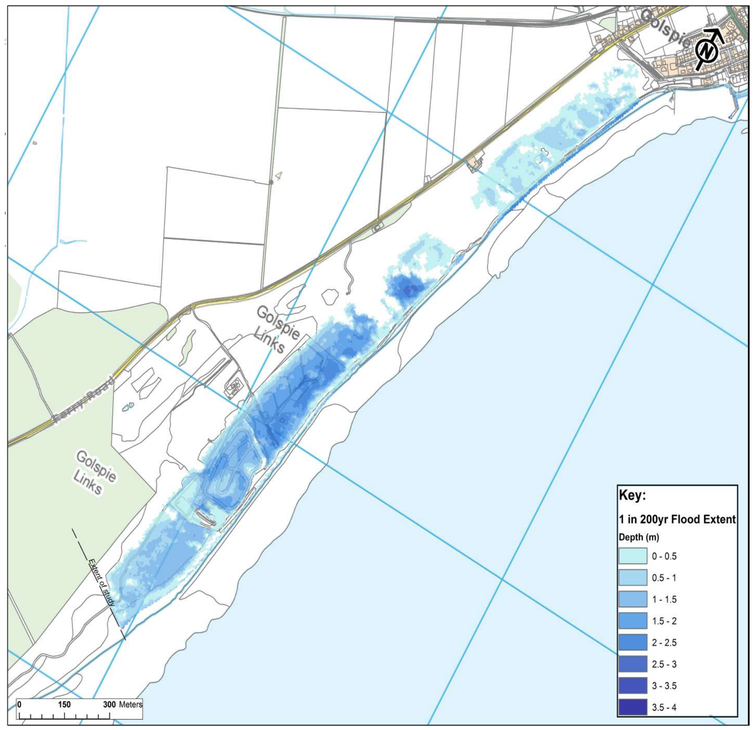
The low-lying area south of the Kart Track and the Caravan Park are first to flood extensively. The embankment bordering the north end of the Kart Track causes floodwaters to accumulate in the Caravan Park before spilling around and over the embankment, quickly flooding the Kart Track.



Predicted 1 in 2yr Flood Extent Map



Predicted 1 in 10yr Flood Extent Map



Predicted 1 in 200yr Flood Extent Map

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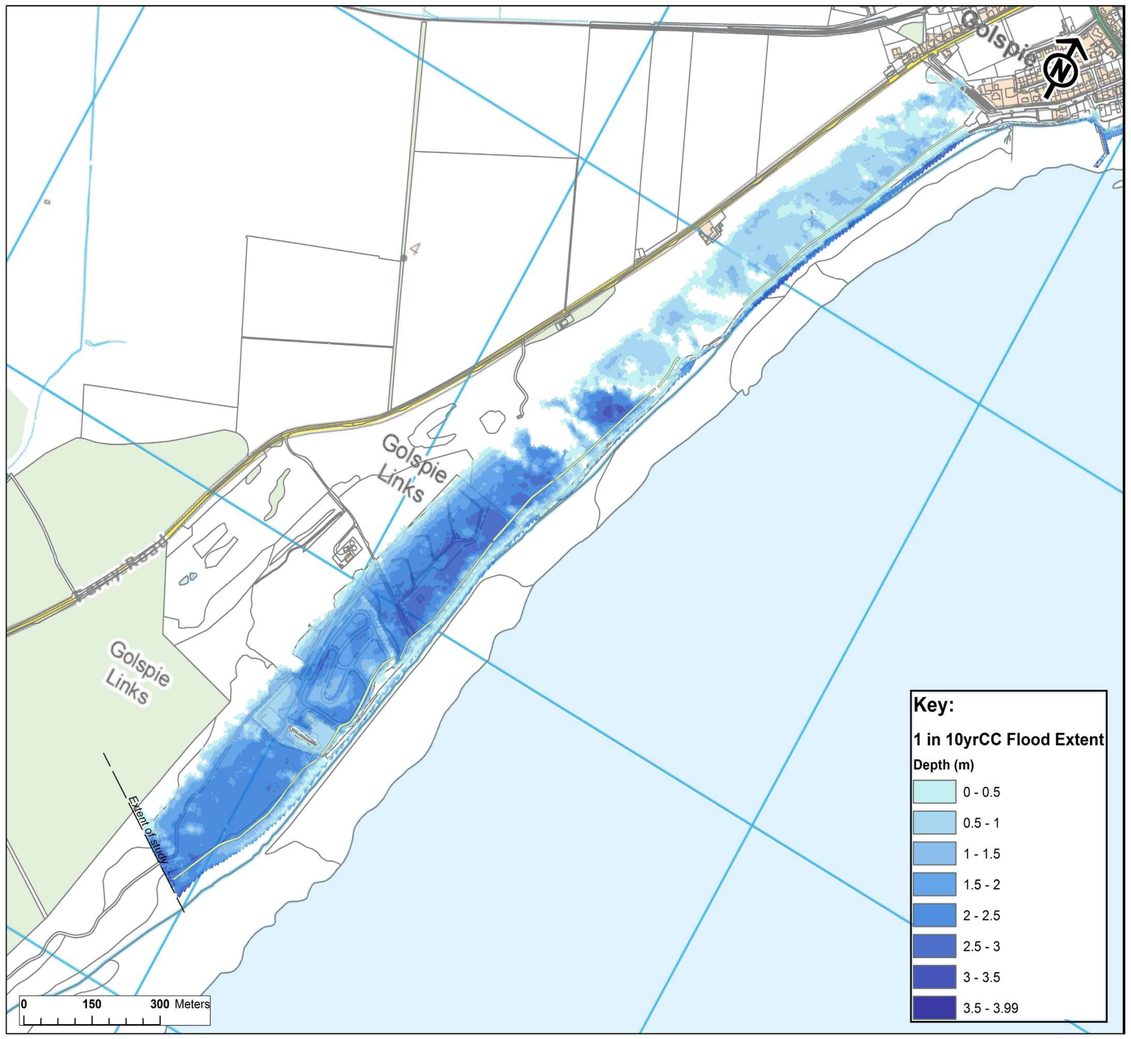
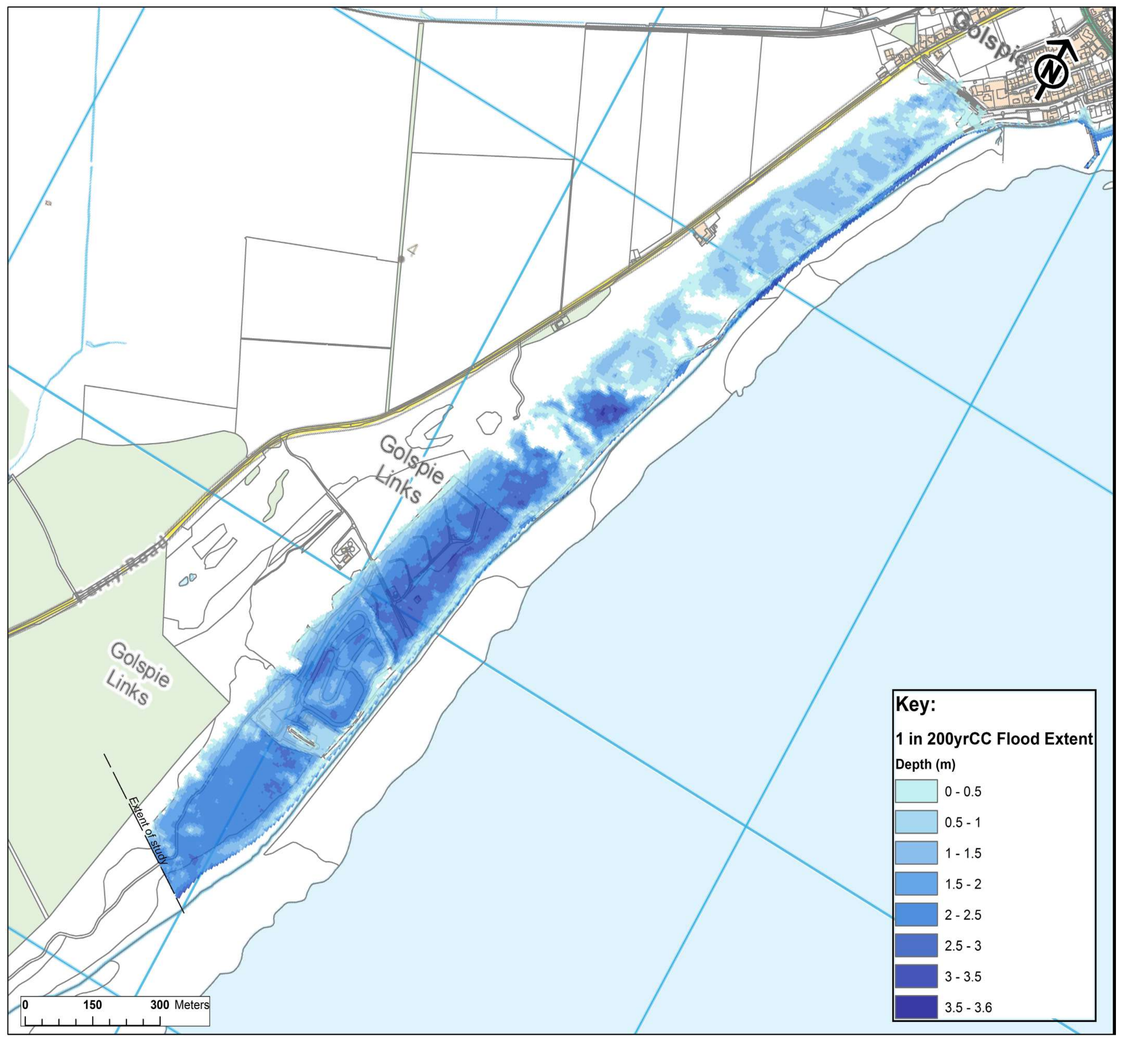
07 What is the scale of the flood risk in Golspie Links?

What about my property?

You may find that your property is located within some of the modelled flood extents for the different scenarios assessed through this Study, however, this has been done at a large scale and does not take into account localised features such as kerbs and garden walls which may affect localised flow paths. Nor does it take into account individual property levels which may be higher than predicated flood levels that have been determined through the modelling.



Predicted 1 in 10yr Flood Extent Map With Climate Change in 100 years



Predicted 1 in 200yr Flood Extent Map With Climate Change in 100 years

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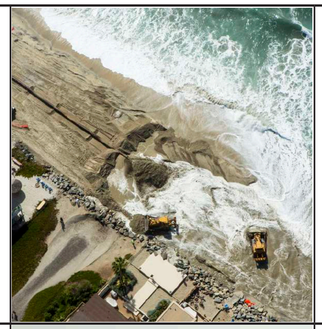
08 What options could be considered?

At this stage we are developing a long list of options to consider to mitigate against flood risk. No measures have been ruled out at this stage.

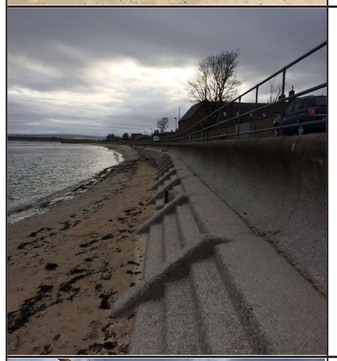
Do nothing

Leave the defences as they are. This would result in the gradual deterioration of the defences and the standard of protection would decrease over time.



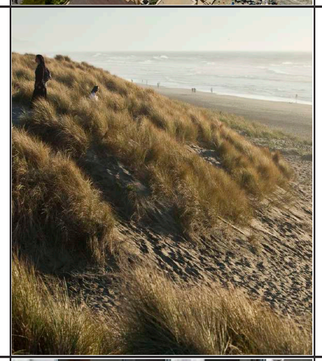
Beach nourishment

Beach nourishment is a method which can be used to restore a beach which has eroded away due to tidal action. Sand is imported and spread to return the beach to original levels. New beach will absorb wave energy and provide a natural but limited mitigation to flood risk. The restoration of the beach will also have recreational value. Works to replace sand will have to be repeated if the cause of erosion is not controlled.



Do minimum

Repairs and strengthening works could be made to the existing wave return wall and culvert flapvalves in the town, and a stringent maintenance regime adopted to maintain the existing standard of protection. This option would strengthen the current defences and reduce their risk of failure. This would maintain the existing situation but would not reduce flood risk.



Sand dune stabilisation and protection

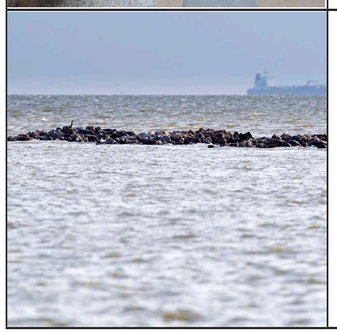
Maintain and protect the sand dunes along the golf course which form natural embankments and can offer some level of protection from tidal flooding. Sand dunes would be stabilised by planting natural species such as marram grass whose root structure would have an interlocking effect on sand particles.

Raise embankments and coastal walls at existing defence line

In order to prevent overtopping at the existing defence line, the coastal defence wall and embankments could be raised to create a barrier to wave carryover and inundation from high sea levels. This would offer an increase in the standard of flood protection for all receptors but it would incur significant cost and result in impacts on various environmental and social receptors.

Property Level Protection (PLP)

PLP can be employed to protect individual properties from potential ingress of flood water through pathways such as doors and windows, brickwork and sewage systems. This option would not address the source of flooding but could act as a resilience measure to protect individual properties against flooding. The success of PLP is heavily dependent on the correct choice of PLP and its installation, operation and maintenance.



Wave energy dissipation

Offshore breakwaters can be used to dissipate wave energy and change wave direction. A hard-engineered measure would involve installing a rubble breakwater some distance offshore to reduce the height and strength of waves before they break on the shoreline, reducing the volume of overtopping due to wave action and therefore reducing flood risk beyond the defence line. This would also reduce impact on existing defences. Additional ecological benefit can be added by installing living breakwaters, which can be designed to dissipate wave energy and encourage biodiversity.

However, the flood risk benefits are limited as this measure would only reduce the impact of wave carryover and not direct tidal inundation when sea level is high.

09 What are the next steps?

Development of a long list of options considering a very wide range of flood mitigation possibilities will be undertaken. From this, a short list will be identified utilising feedback from the Core Project Stakeholders and the public. Finally a preferred option will be identified following an assessment of the technical, economic and environmental considerations. As part of the scheme appraisal an economic assessment will be undertaken comparing the economic benefits of the scheme against the scheme cost. There will be further public consultation during these next stages in the study.

A report containing the current flood risk and recommendations for the future management of coastal flood risks in Golspie will be produced. If a viable scheme is identified through this study, the results will be compared to the results of other flood studies being undertaken in the Highlands and nationally over the next few years, and this will identify a priority list for flood protection works.

How to provide your feedback?

The Highland Council project team welcome your comments on the Golspie Coast Flood Protection Study.

You can provide it in various ways:

- Feedback form available at the exhibition;
- Speaking directly to the project team at the exhibition; or
- Contacting the project team after the exhibition using the details adjacent.
- Details of the study will also be posted on the Highland Council website after the exhibition.

Contact information

Flood Risk Management Team

Development and Infrastructure Service,

The Highland Council,

Project Design Unit,

Council Offices,

Dingwall,

IV15 9QN

Tel no. 01349868800

Email: FRM@highland.gov.uk

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10 Responsibilities for flooding and self-help

You are the first line of defence against flooding. However public bodies have responsibilities too, and together we are working towards reducing the overall impacts of flooding in Scotland.

To find out more about all of our responsibilities please visit the following link:

https://www.sepa.org.uk/environment/water/flooding/responsibilities-for-flooding/

It is your responsibility to manage your own flood risk and protect yourself, your family, property and business. Being prepared by knowing what to do and who to contact if flooding happens, can help you reduce the damage and disruption flooding can have on your life.

The following information can assist you in managing your own flood risk:

SEPA Duties - National Flood Maps & Flooding Warning Service

SEPA's flood maps are designed to help you understand how you could be affected by flooding. The maps show areas which are likely to flood from rivers, the sea and surface water.

These can be found online at:

https://www.sepa.org.uk/environment/water/flooding/flood-maps/

Floodline

The best way to be prepared for flooding is to sign up for free, advance notice of flooding from Floodline. When you are signed up to Floodline and flooding is forecast in your area, we will send you a message by phone or text, advising that a Flood Warning or Flood Alert has been issued and where to go to find out more about the flooding situation. Sign up takes just a few minutes and all flood messages are free.

Sign up online at:

https://www.sepa.org.uk/environment/water/flooding/floodline/

Relevant Alerts - Moray Firth Coast

Five easy steps to prepare for flooding

1. Sign up to Floodline to receive free advance notice of when and where flooding might happen

2. Prepare a flood plan and put a family flood kit together so everyone knows what to do if flooding happens

3. Familiarise yourself with how to shut off gas, electricity and water supplies

4. Keep a list of useful contact numbers including your Floodline quickdial code

5. Consider flood protection products that could help to reduce the impact of flooding on your property and ensure your insurance provides adequate cover for flood damage