Borders Flood Studies

How is flood risk managed by the Scottish Borders Council?

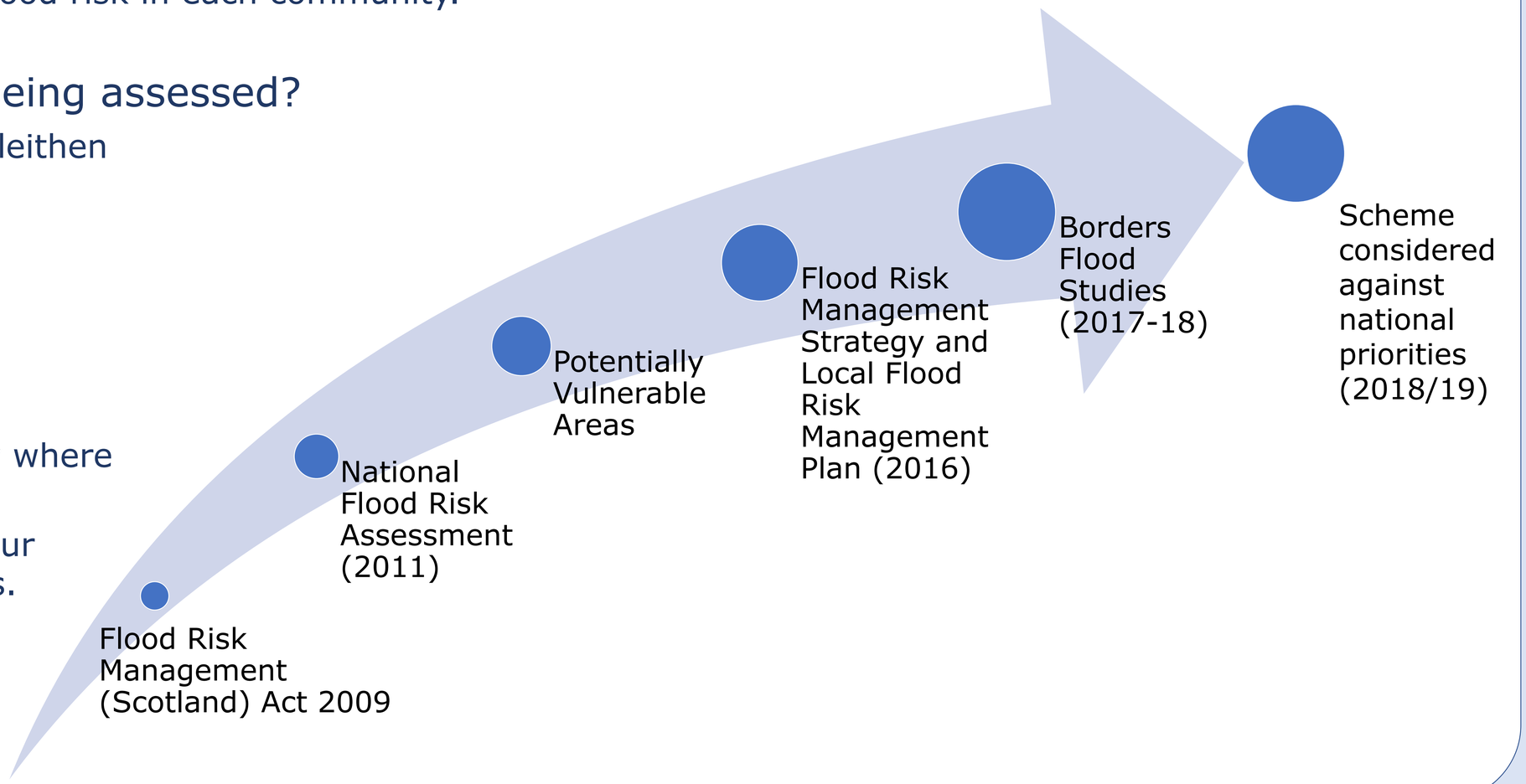
- The Flood Risk Management (Scotland) Act 2009 aims to prioritise flood mitigation across Scotland using a proactive and risk based process for assessing flood risk.
- This approach led to the preparation of SEPA's Flood Risk Management Strategies by SEPA and the Tweed Local Flood Risk Management Plan developed by the Scottish Borders Council as the Lead Local Authority for the Tweed Local Plan District.
- These plans identified specific communities as being at risk and in need of a detailed flood study to help inform the management of flood risk in each community.

Which communities are being assessed?

- **Peebles**, Broughton & Innerleithen
- Newcastleton
- Earlston

How will Flood Protection Schemes be prioritised?

- SEPA will prioritise nationally where funding should be allocated.
- The reports and findings of our study will inform this process.



What are the study objectives?

1) Develop better understanding of flood risk in the community

- Create, update or develop new/existing flood model information;
- Determine existing flood risk;
- Develop improved flood mapping;

2) Develop recommendations for management of flood risk

- Develop a range of options to manage flood risk, including structural and non-structural options;
- Appraise actions to manage flood risk (consider the pros and cons and economic viability for all proposed options);
- Recommend options for the future management of flood risk;

3) Select a preferred approach to manage flood risk in each community and identify recommendations that the Council will take forward

- SEPA will prioritise nationally where funding should be allocated;
- The reports and findings of our study will inform this process.

4) Engage partners and stakeholders

- **Today's consultation**.

Why choose a 200 year standard of protection?

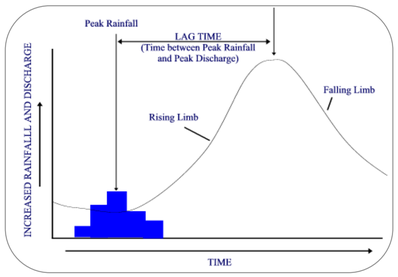
- Scottish Planning Policy requires new build properties to have a 200 year standard of protection
- This standard is accepted as low risk by the flood insurance companies.
- A higher standard of protection will mean the scheme will be considered more favourably by SEPA's scheme prioritisation making funding more likely

What has been done so far?

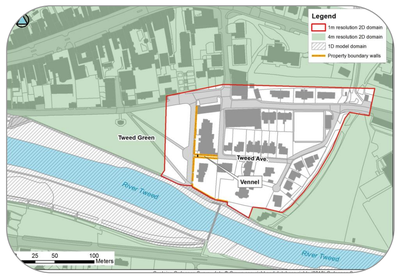
Flood Review

Topographic surveys

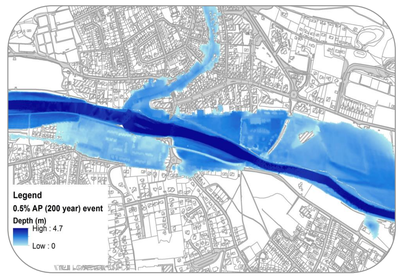
Asset inspections



Hydrology

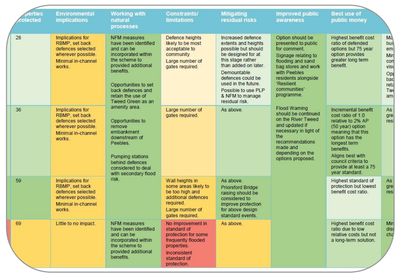


Modelling

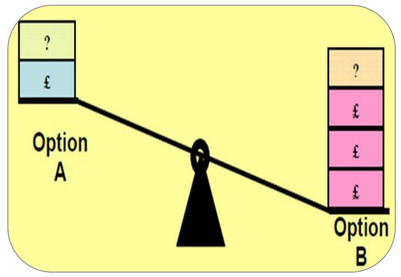


Flood Mapping

Properties at risk



Options Appraisal



Cost-Benefit

The studies aim to better assess current flood risks in the community by undertaking a review of past flood events; generating updated and detailed flood maps, determining the likely risk to different properties; and to propose a set of mitigation measures to reduce the flood risk to an acceptable level.

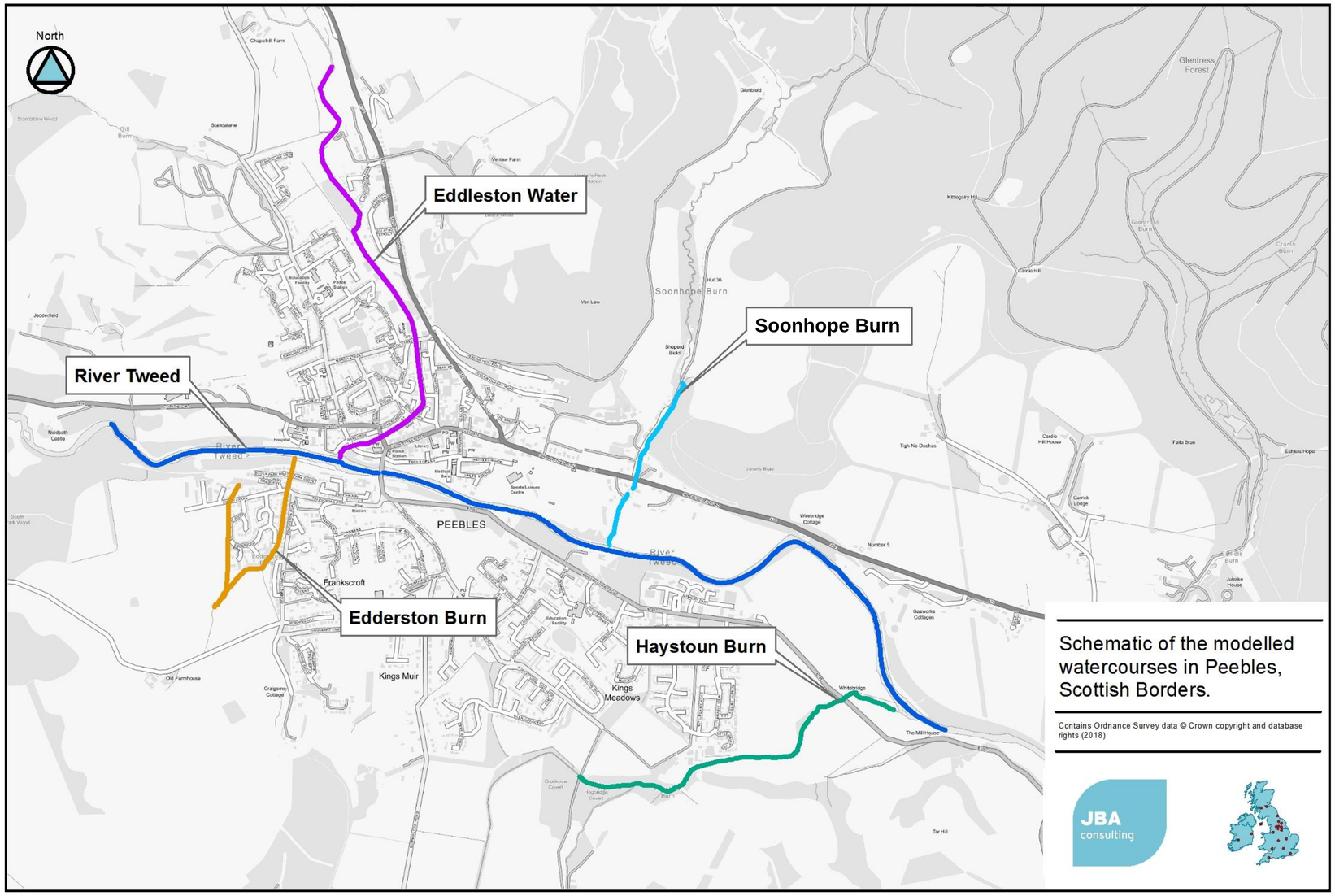
The models developed form a basis for assessing future flood levels, flood mitigation options, detailed design of schemes and the costs to deliver.

Return periods and annual probabilities

- When a river floods the severity of the flood is known as a 1 in x year flood. This terminology represents the probability of that event occurring in any year.
- For reference, the December 2015 event (Storm Frank) on the River Tweed in Peebles had a 1 in 55 chance of occurring in any year.
- This does not mean that the flood will occur once every 55 years; it could occur tomorrow and again next week, or not for another 200 years. But on average a flood of that severity will occur once every 55 years.
- For example, there is a 1 in 100 (or 1%) chance of a flood exceeding the 100 year flood in any one year.

Assessed watercourses

Peebles is at flood risk from the River Tweed, Edderston Burn, Eddleston Water, Soonhope Burn and Haystoun Burn. Each of the watercourses has its own mechanism of flood risk and the individual watercourses were therefore studied independently. The River Tweed is the largest of the assessed watercourses with a catchment area of 700km^2 followed by the Eddleston Water (70km^2), Haystoun Burn (23km^2), Soonhope Burn (9.5km^2) and finally the Edderston Burn with a catchment area of under 2km^2. Some of the watercourses such as the Eddleston Water and the River Tweed have a long history of flooding whereas others have little available flood history.



Flood Timeline - Haystoun Burn

SEPA's flood maps

Regional flood mapping suggests that there is a high (10% Annual Probability) of flooding from the Haystoun Burn to properties on the Kittlegairy Estate. These properties are generally low lying and the roads are expected to channel flows rapidly downslope towards the B7062 road.

2015

December flood event, Haystoun Burn burst its banks and flowed across the floodplain, through Whitehaugh Farm and into the Kittlegairy estate, however, no residential property flooding was reported.

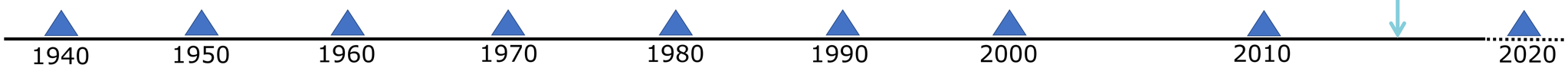
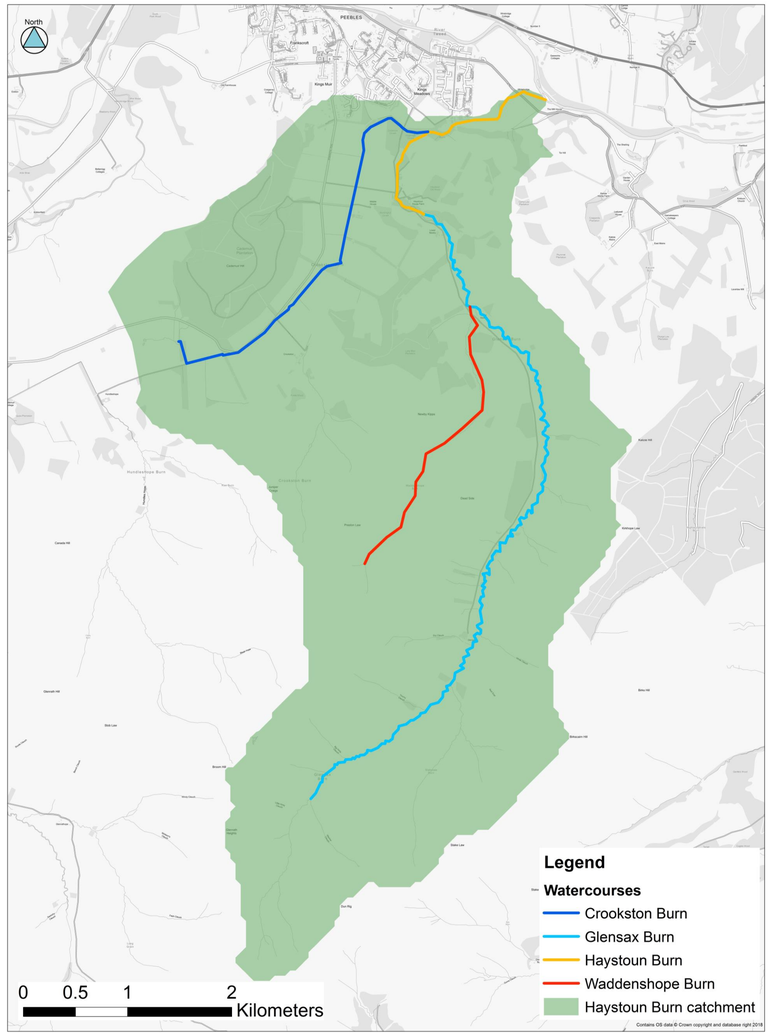


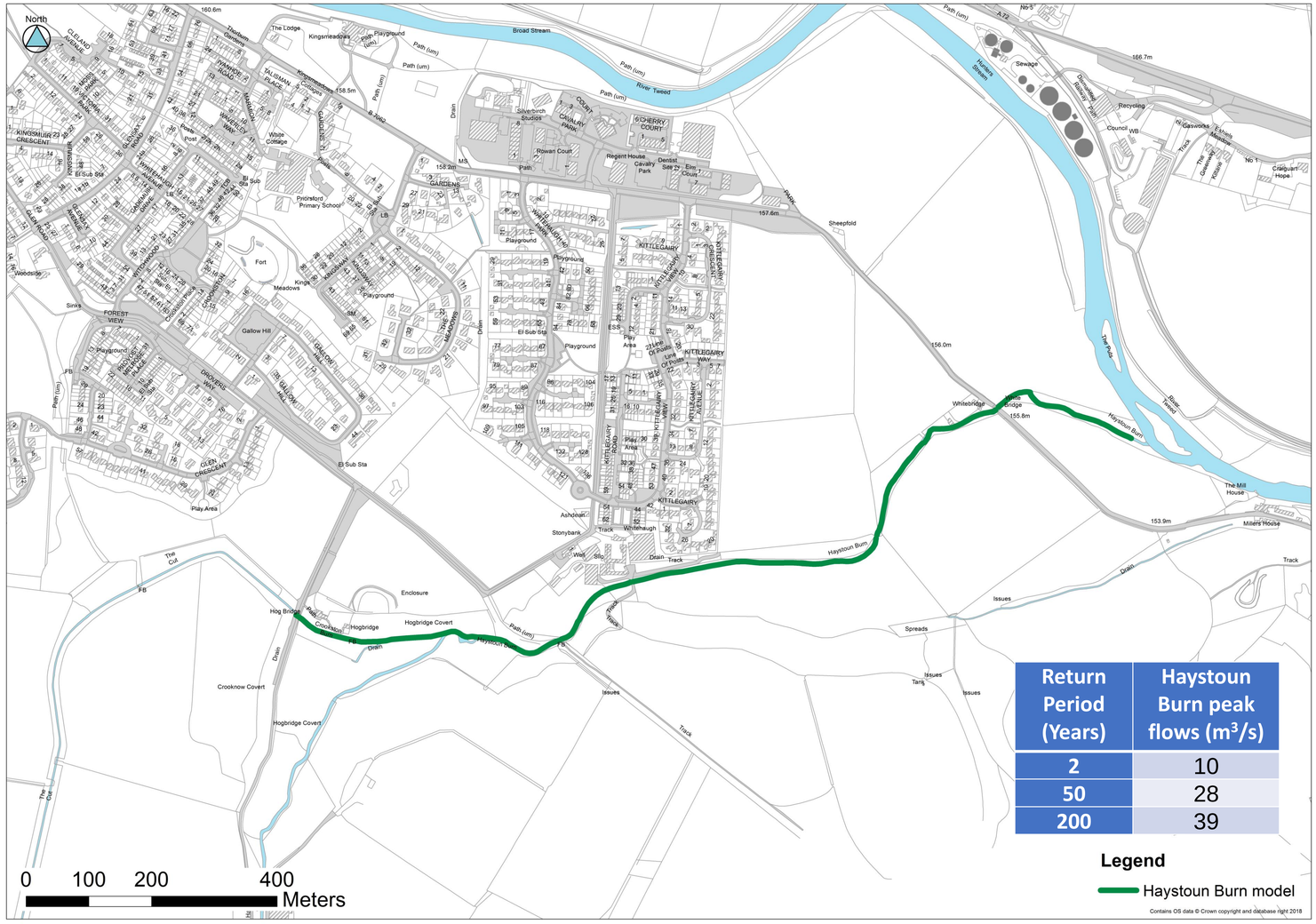
Photo shows the December 2015 flooding on the Haystoun Burn. The owner of Whitehaugh Farm reported that this field was completely inundated during the flood peak.

No further reports of flooding have been found. Kittlegairy Estate is a relatively new development so flooding is not likely to have caused a significant problem prior to its construction.

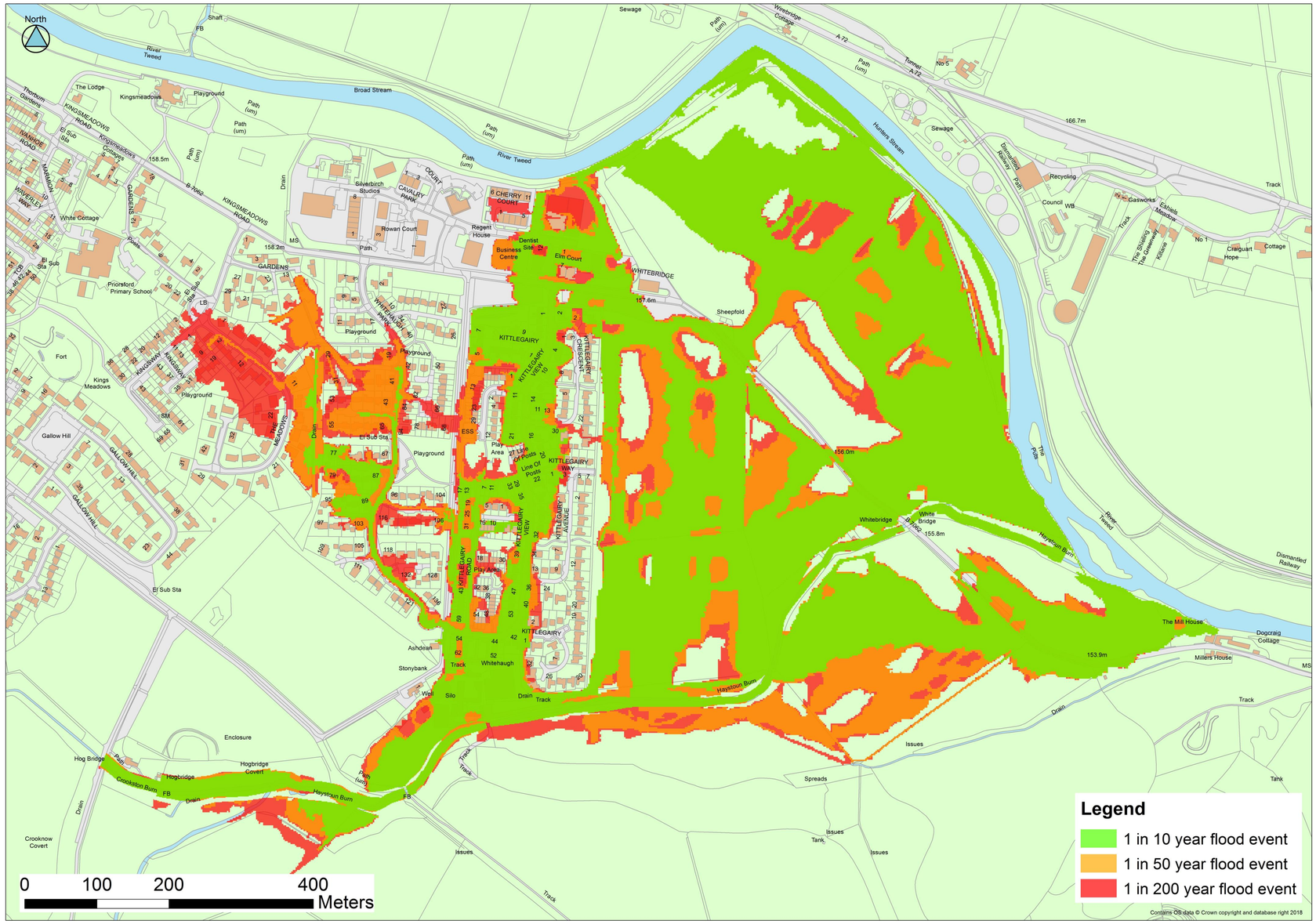
Catchments and watercourses

The Haystoun Burn has a catchment area of 24km^2 and encompasses several watercourses. The combined flow from these watercourses were modelled on the the Haystoun Burn from downstream of the Crookston Burn to the confluence with the River Tweed. The figures below show the catchment and the length of modelled channel.





Flood mapping – Haystoun Burn



Property Type	Number at Risk *(1 in 200 year flood)*
Residential	171
Commercial	21

How do we create these flood maps?

- A physical survey captured the measurements of river channels, banks and structures along each watercourse.
- These measurements were input to a computer model, along with calculated river flows for a range of storm events.
- This model produced a flood outline and estimated flood depths based on a 3D representation of the land surface and buildings. The outcome resulted in a detailed flood map.

What do the maps show?

- The mapping indicates the predicted flooding for a given flood magnitude.
- The 1 in 10 year map shows what is expected to be inundated for a flood that is likely to occur once every 10 years (or with a probability of 10% in any one year).
- The 1 in 200 year represents a flood event with a probability of 0.5% in any year.

Flood mechanisms on the Haystoun Burn

Out of bank flow paths, key structures and constraints were identified. Flood flows are known to leave the burn at Whitehaugh Farm and pass through the agricultural land before reaching Kittlegairy Estate. Although flooding to gardens in the estate has been observed, during larger flood events flooding is expected to extend throughout the estate and neighbouring streets causing predominantly shallow flooding to properties. The estate is a relatively new development and prior to its construction this flow pathway would have naturally drained to the River Tweed without major disruption.

Floodplain flows

Previous flood event

Has this flow mechanism been seen before?

Flood water from the Haystoun Burn is known to flowed through Whitehaugh Farm and gardens of new properties in Kittlegairy Estate. Although extreme floods have not been witnessed, there is the potential for a large number of properties to be at risk during these events.

Haystoun Burn Options appraisal – Long list of options

The process for selecting flood mitigation options involves assessing a wide range of possible measures and narrowing it down to a short list according to whether the options are technically, environmentally and socially acceptable. Those that are short listed are shown in the following posters. The full list of options assessed is provided below:

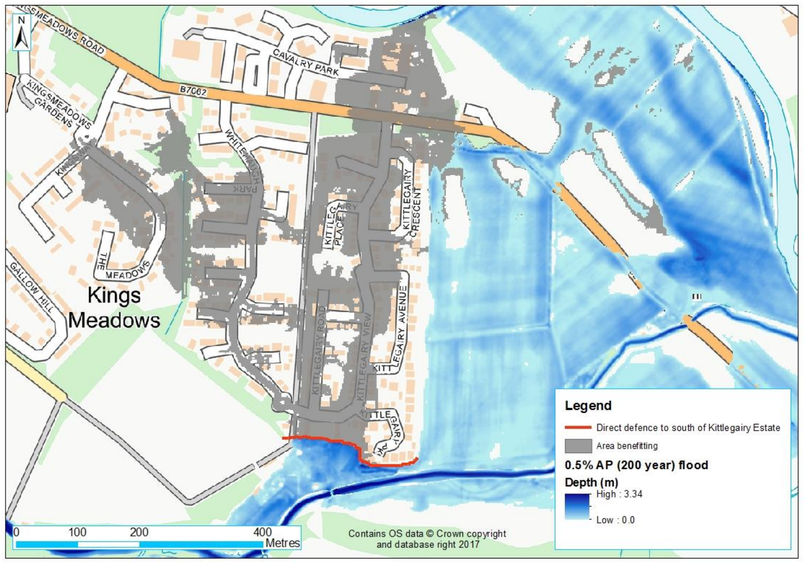
- **Relocation -** Relocation or abandonment of properties not usually socially or politically viable.
- **Flood Warning –** A gauge should be installed on the burn and flood warning setup.
- **Resistance Measures –** Property level protection is well suited to the shallow flood depths expected from the Haystoun Burn.
- **Resilience Measures -** Unlikely to be economically or socially viable due to the large number of new properties.
- **Watercourse Maintenance –** Council should continue the scheduled maintenance regime.
- **Natural Flood Management –** Some opportunities identified within the upper catchment.
- **Storage –** Two large storage structures, one on each sub-catchment would be required and these would cause significant impact on the natural environment.
- **Control structures –** Likely to cause more negative impacts in terms of the environment and maintenance than the benefits that would be provided.
- **Demountable Defences –** Permanent walls or embankments are more suitable than demountable defences.
- **Direct Defences –** A combination of walls and embankments could contain flows on the watercourse to a high standard of protection.
- **Channel Modification –** Not capable of delivering long-term benefits.
- **Diversion channel –** No suitable route for the diversion upstream of the properties at risk.
- **Structure Modification –** Structures are not a primary cause of flooding on the burn.

Most desirable options
Good practice and partial solutions
Least desirable options

Haystoun Burn – Short Listed Options

Option 1:
Direct flood defences (flood walls)

- This option provides a 200 year standard of protection to the properties to the north of Whitehaugh Farm including Kittlegairy Estate – the farm is not protected.
- Average wall height of 0.7-1.5m.
- Climate change adaptation could be possible but wall heights and extents would be greater.
- Estimated cost £2m
- Estimated damage avoided £15.2m



Proposed flood defences

See adjacent technical drawings for further details for these options

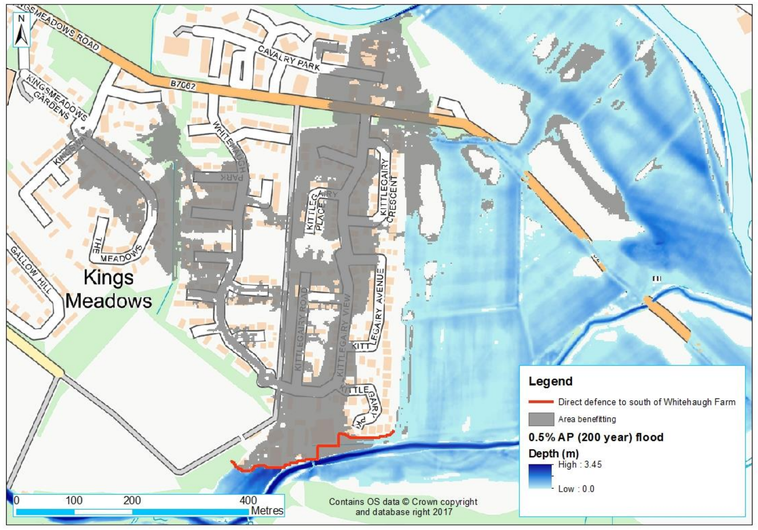
Typical example of a flood wall

Image compliments of Flood Control International

Typical example of a flood embankment

Option 2:
Direct flood defences (flood walls and embankments)

- This option provides a 200 year standard of protection to the properties to the north of Whitehaugh Farm including Kittlegairy Estate.
- Average wall height of 1.7-2.0m.
- Climate change adaptation could be possible but wall heights and extents would be greater.
- Estimated cost £2.75m
- Estimated damage avoided £16.1m



Proposed flood defences

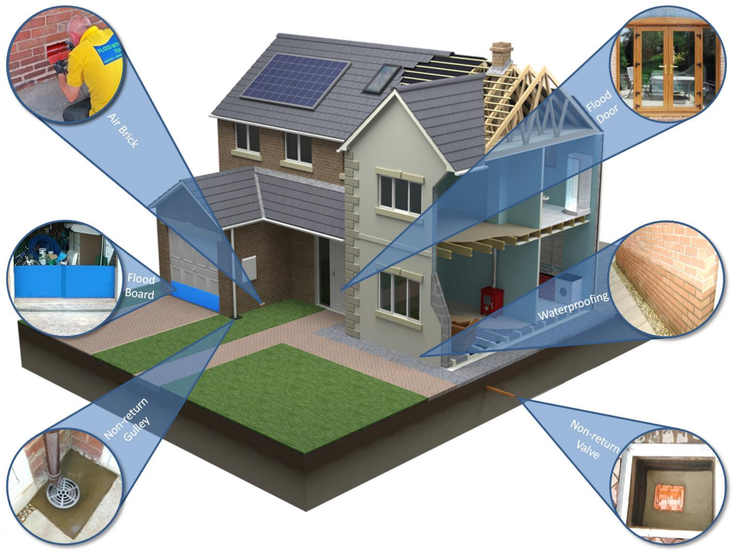
Haystoun Burn – Short Listed Options

Option 3:
Property Level Protection (PLP)

PLP is the last form of defence before water gets into a building. Automatic PLP is proposed for each residential property at risk of flooding. Two properties would continue to flood from 1 in 10 and 25 year floods but in general at least a 1 in 50 year standard of protection would be achieved. Whitehaugh Farm is not included in the costs for PLP since it is assumed to be highly resilient and would require bespoke PLP. PLP will be provided to 171 residential and 12 non-residential.

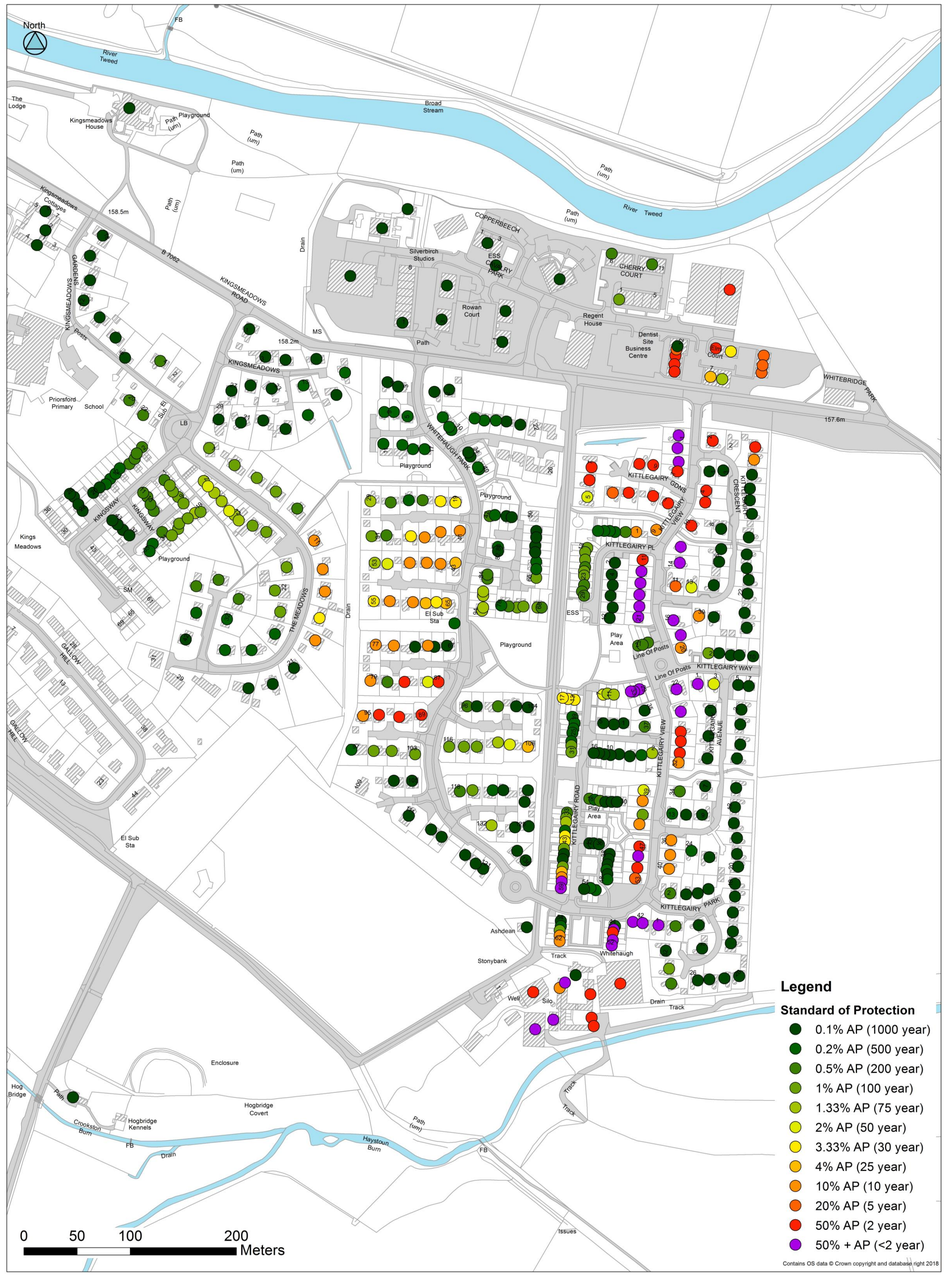
PLP would involve surveying each property to identify entry points and recommend appropriate PLP, but could include self sealing doors, air bricks and non return valves on plumbing.

- Estimated cost £5.4m
- Estimated damage avoided £12.9m



Examples of how Property Level Protection can mitigate the risks of flood inundation (image courtesy of Whitehouse Construction Co. Ltd)

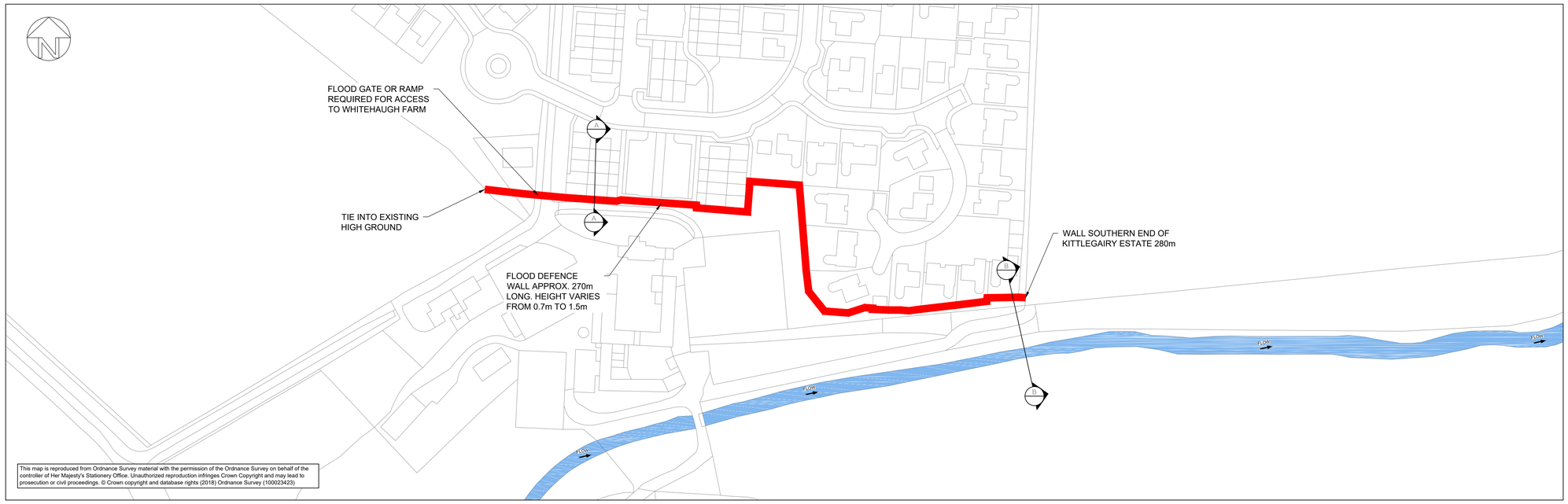
Standard of protection map



The standard of protection (SOP) map indicates the existing level of protection for each property in the flood study.

Peebles
Option 1: Haystoun Burn
200 Year Set Back Defence

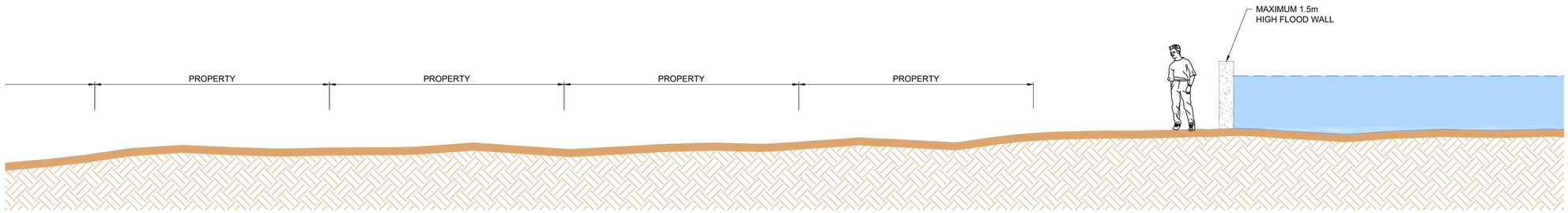
OPTION SUMMARY. Direct defences to the north of Whitehaugh Farm. Option provides a 1 in 200 year standard and cuts off key flow path from the burn to the north through the Kittlegairy Estate.



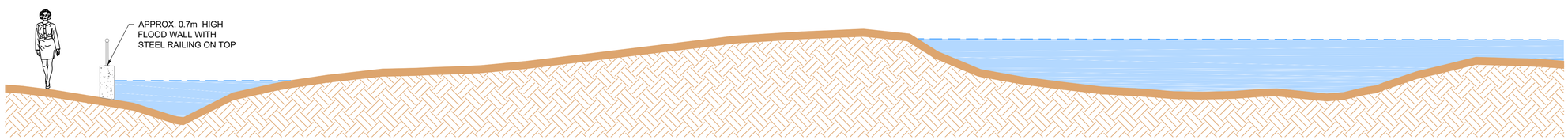
PLAN
1:1000

LEGEND

- EXISTING GROUND LEVEL
- 200 YEAR WATER LEVEL
- EXISTING WATERCOURSE
- CONCRETE FLOOD WALL



SECTION A-A
1:50



SECTION B-B
1:50

Rev.:	Comments	Date	Drawn	Designed	Checked	Approved

Client Approval

- A - Approved
- B - Approved with Revisions
- C - Do Not Use

Purpose of Issue: Suitable for Coordination

Status: S1

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Project: Borders Flood Studies

Title: Peebles
Haystoun Burn: Option 1
200 Year set back defence
for

Client: MOTT MACDONALD / Scottish Borders Council

Scale: As Shown @ A1

Drawn:	A Coad	13/02/18
Designed:	T Fletcher	12/02/18
Checked:	A Pettit	12/02/18
Approved:		

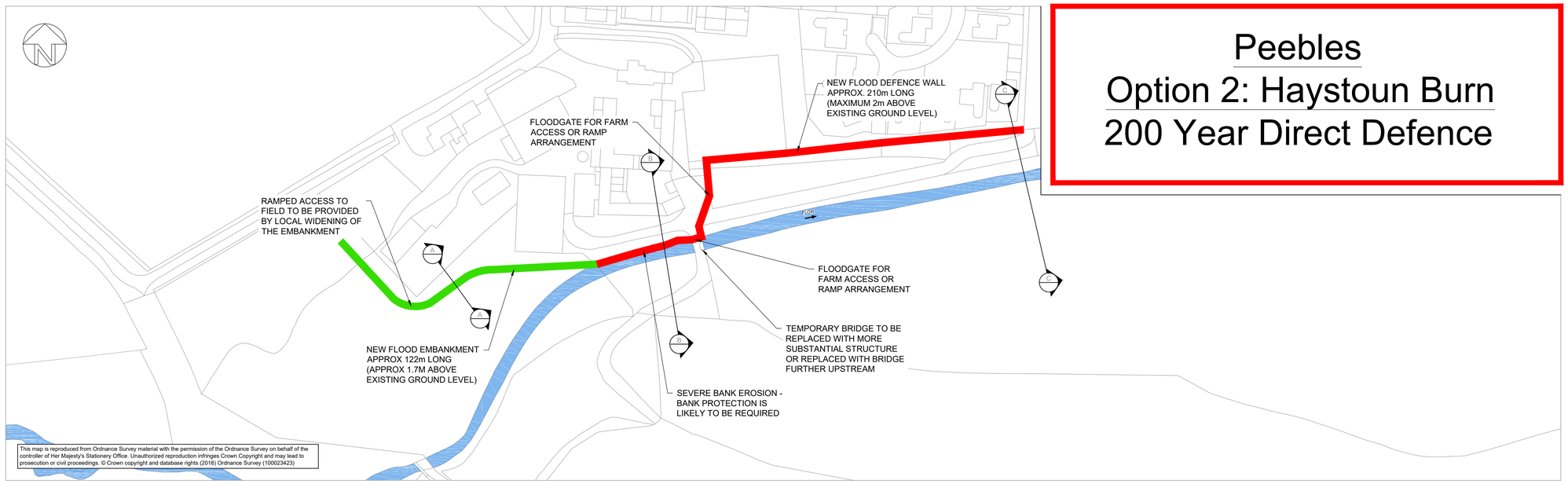
Project Number: 2017s5526

Drawing Number: AEM-JBAU-PB-HB-IM-C-1100

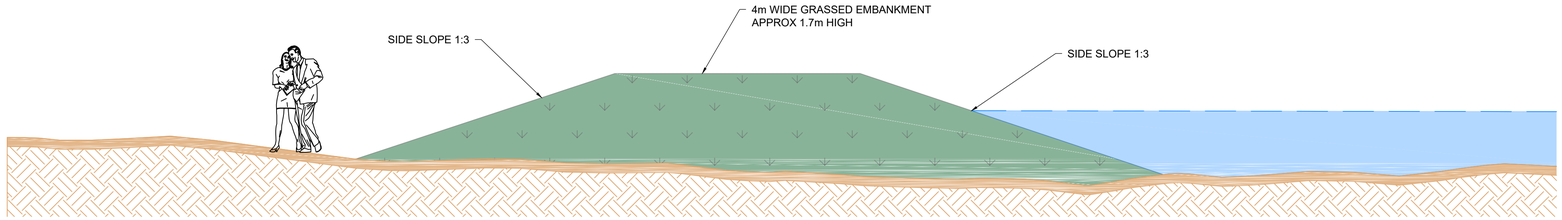
Revision: P02

Peebles
Option 2: Haystoun Burn
200 Year Direct Defence

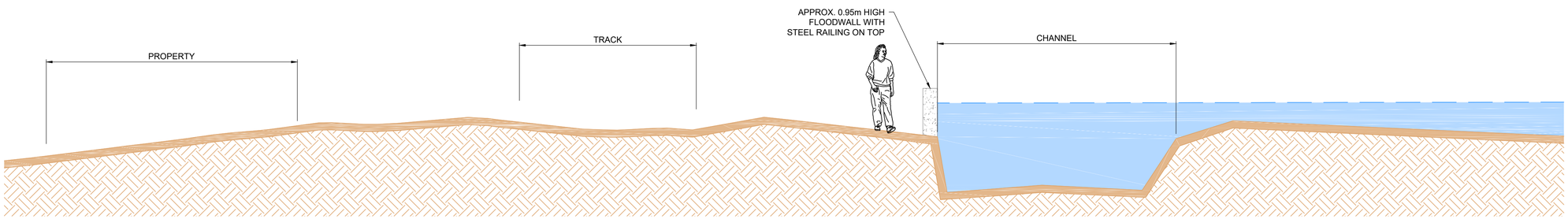
OPTION SUMMARY: Direct defences to the south of Whitehaugh Farm. Option provides a 1 in 200 year standard and cuts off key flow path from the burn to the north through the Kittlegairy Estate. Option provides protection to Whitehaugh Farm.



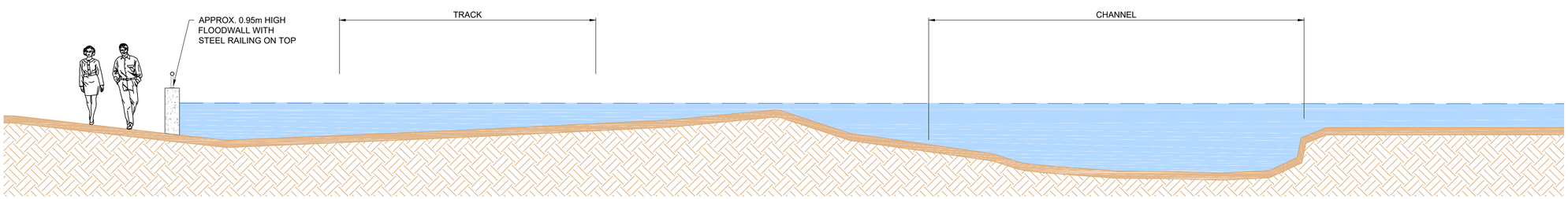
PLAN
1:1000



SECTION A-A
1:50



SECTION B-B
1:50



SECTION C-C
1:50

LEGEND

- 200 Year water level
- Finished Ground Level
- Existing Ground Level
- Existing Watercourse
- Embankment
- Wall

Rev.:	Comments	Date	Drawn	Designed	Checked	Approved

Client Approval

- A - Approved
- B - Approved with Revisions
- C - Do Not Use

Purpose of Issue: Suitable for Coordination

Status: S1

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Project: Borders Flood Studies

Title: Peebles
Haystoun Burn: Option 2
200 Year Direct defences
for

Client: MOTT MACDONALD / Scottish Borders Council

Scale: As Shown @ A1

Drawn:	A Coad	13/02/18
Designed:	T Fletcher	12/02/18
Checked:	A Pettit	12/02/18
Approved:		

Project Number: 2017s5526

Drawing Number: AEM-JBAU-PB-HB-IM-C-1200

Revision: P02

Preferred Option for Haystoun Burn

Summary of short listed options

Option (Standard of protection)	Properties protected	Environmental implications	Working with natural processes	Constraints/ limitations	Mitigating residual risks	Improved public awareness	Best use of public money
Option 1 - Direct Defences not protecting Whitehaugh Farm (0.5% AP - 200 year)	172	Few implications for RBMP. No in-channel works required so little impact on watercourse.	NFM Measures have been identified and, subject to further investigation, could be incorporated within the scheme to provide additional environmental benefits. Further modelling and discussion with landowners is required to determine the most appropriate measures and locations for these works and the benefits they may provide.	Whitehaugh Farm not protected.	Whitehaugh Farm buildings expected to be resilient but may require some remedial works to increase resilience. Increased defence extents and heights possible but should be designed for at this stage rather than added on later. Possible to use NFM to manage residual risk.	Options should be presented to public for comment. Signage relating to flooding and sand bag stores and work with Peebles residents alongside 'Resilient communities' programme. Flood Warning should be implemented on the Haystoun Burn, especially if flood gates are required as part of the final design.	Benefit cost ratio of 7.7. Highest benefit cost ratio of defended options.
Option 2 - Direct Defences protecting Whitehaugh Farm (0.5% AP - 200 year)	183	Some implications for RBMP due to walls on riverside. Minimal in-channel works but some bank reinforcement likely.		May be slight complications for farm access across the river.	Increased defence extents and heights possible but should be designed for at this stage rather than added on later. Possible to use NFM to manage residual risk.		A benefit cost ratio of 5.9. Whilst the benefit cost ratio is lower than Option 1, this option protects more properties.
Option 3 – Property Level Protection (PLP) (20% AP – 5 year)	183 at the 0.5% AP (200 year) flood event	Little to no impact. Does not mitigate the risks of contaminated runoff from the farm into Kittlegairy Estate.		Little improvement in standard of protection for some properties e.g. Whitehaugh Farm Inconsistent standard of protection.	Possible to use NFM to manage residual risk.	Flood Warning should be implemented on the Haystoun Burn.	A benefit cost ratio of 2.8. This option also has a strong benefit cost ratio but is the lowest of the three options. PLP is not seen as a long term solution.

Negative | Neutral | Positive

Preferred Options and recommendations

The preferred option for Haystoun Burn is Option 2 - the direct defences option protecting to a 200 year flood event and protecting Whitehaugh Farm. This could be implemented alongside natural flood management.

The PLP option could be progressed outwith a formal flood protection scheme in collaboration between SBC and homeowners.

The short term recommendations are:

- Awareness raising for flooding.
- Setup new sandbag store on Kittlegairy Estate.
- Monitor bank erosion and carry out bank remedial work where required.
- Manage vegetation on the banks and in-channel.

What can we do in terms of natural flood management?

What is natural flood management?

Natural flood management (NFM) is when natural processes are used to reduce the risk of flooding by slowing flows and storing water within the catchment. It is however difficult to quantify the reduction in flow that these types of measures can deliver. NFM also offers additional wider benefits by restoring habitats and improving water quality.

NFM opportunities were first identified by examination of aerial photography and were confirmed with a site visit at sample locations.

The NFM measures which have been proposed for the Haystoun catchment include:

- Upland drain blocking and online storage ponds
- Working within the banks (buffer strips, debris dams)
- Woodland planting including in gully's
- Remeandering

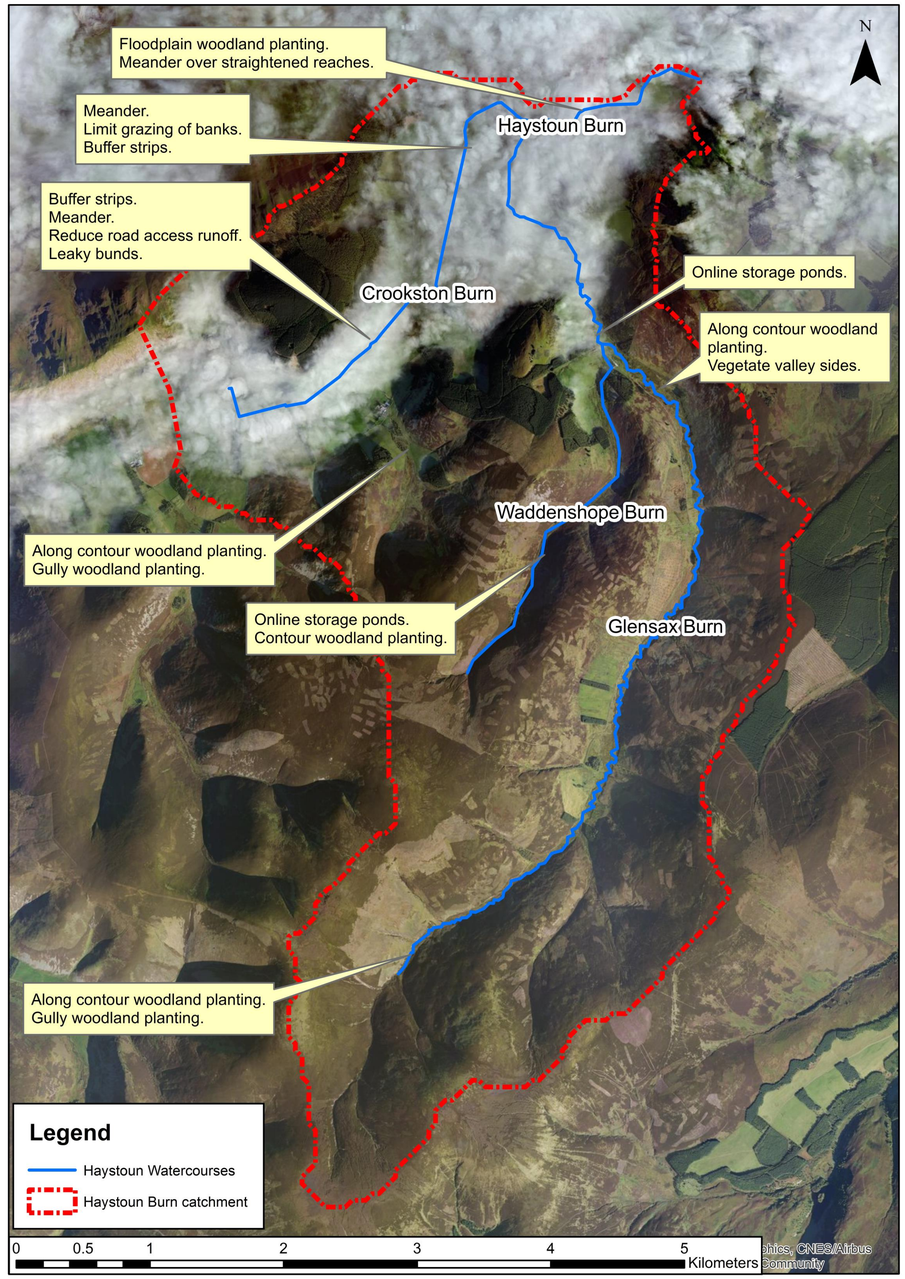
The Council will need to investigate the potential benefits before working with other parties on developing these options further.

Typical example of a meandered channel

Typical example of in-channel debris barrier

Typical example of young woodland

Location and type of measures suggested for the Haystoun Burn catchment



What happens next?

The following sets out the Council wide steps required to progress preferred options to a Flood Protection Scheme

Option appraisal and first round of public consultation
- October/November 2018

SBC Council review and decision to enact preferred options
- January 2019

Selected Flood Protection Schemes taken forward to outline design stage
- 18 months

Issue proposed and selected schemes to SEPA for prioritisation
- December 2019

Further consultation on outline design

Schemes prioritised for 2021 FRM cycle

Scheme approval by Council, stakeholders and public

Carry out detailed design of flood protection measures

Produce tender documents and procure contractor

These posters and further information are available at: www.bordersfloodstudies.com