

How is flood risk managed by the Scottish Borders Council?

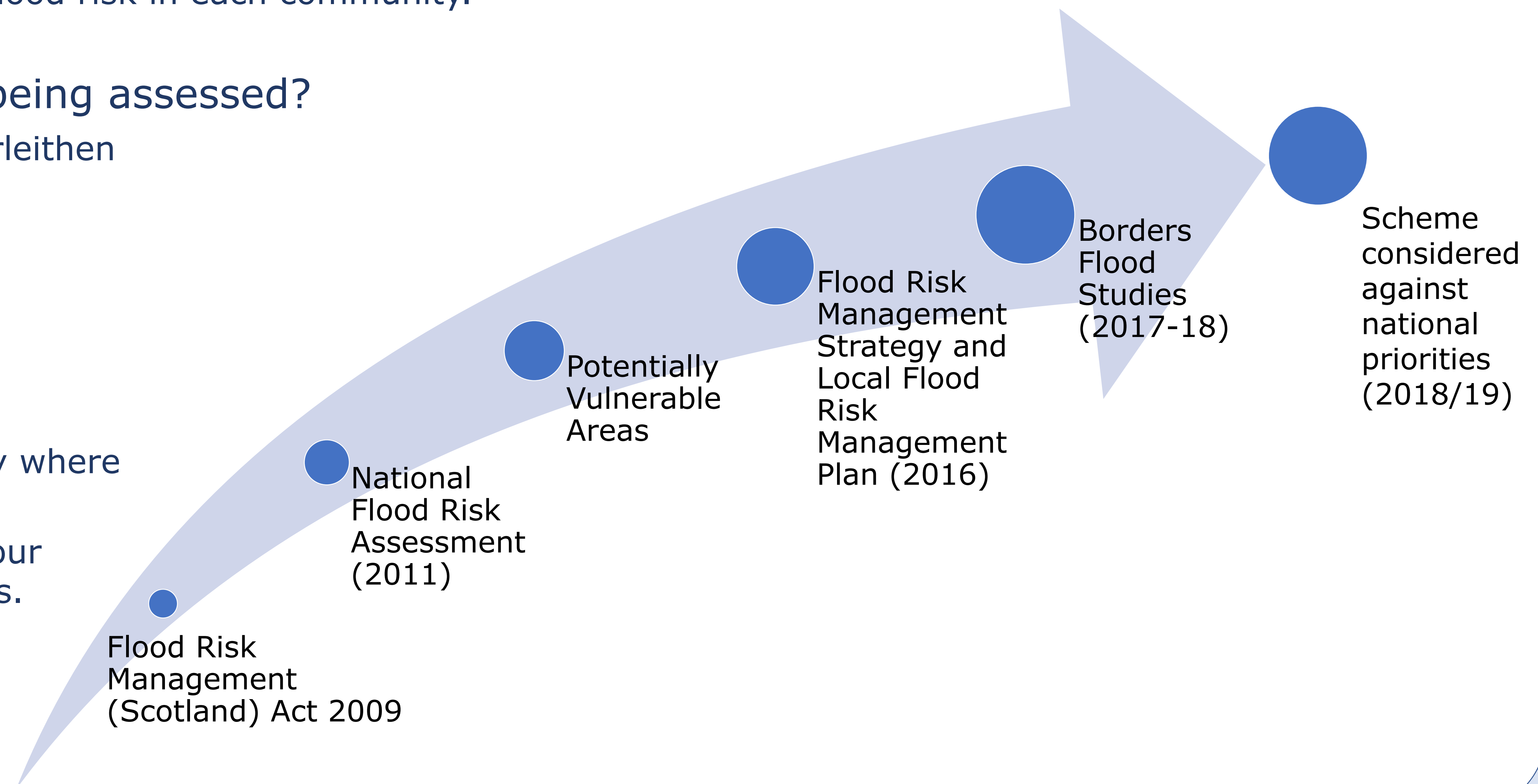
- The Flood Risk Management (Scotland) Act 2009 aims to prioritise flood mitigation across Scotland using a proactive and risk based process for assessing flood risk.
- This approach led to the preparation of SEPA's Flood Risk Management Strategies by SEPA and the Tweed Local Flood Risk Management Plan 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



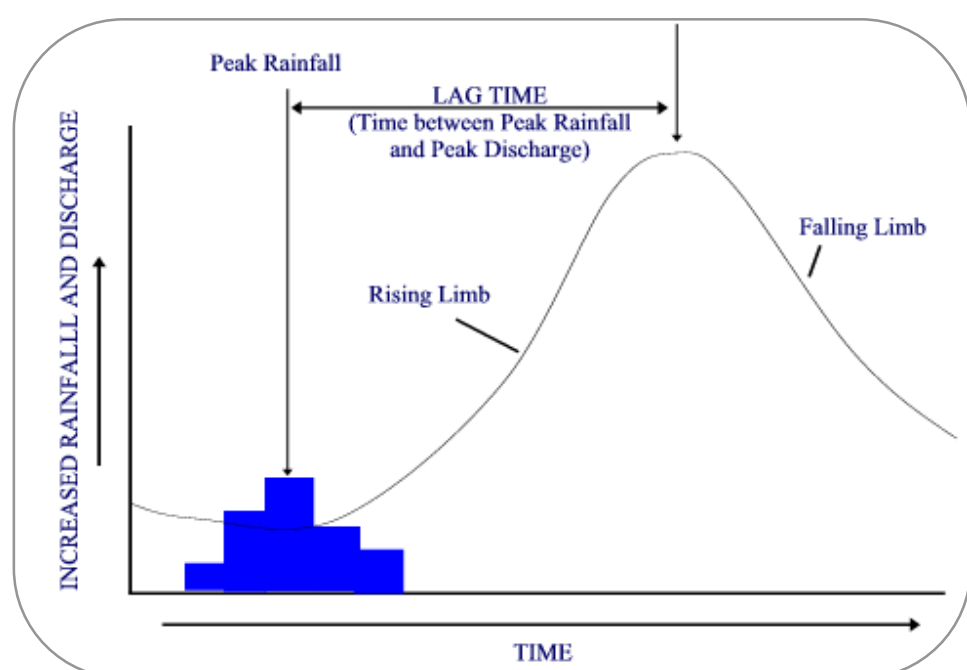
Topographic surveys



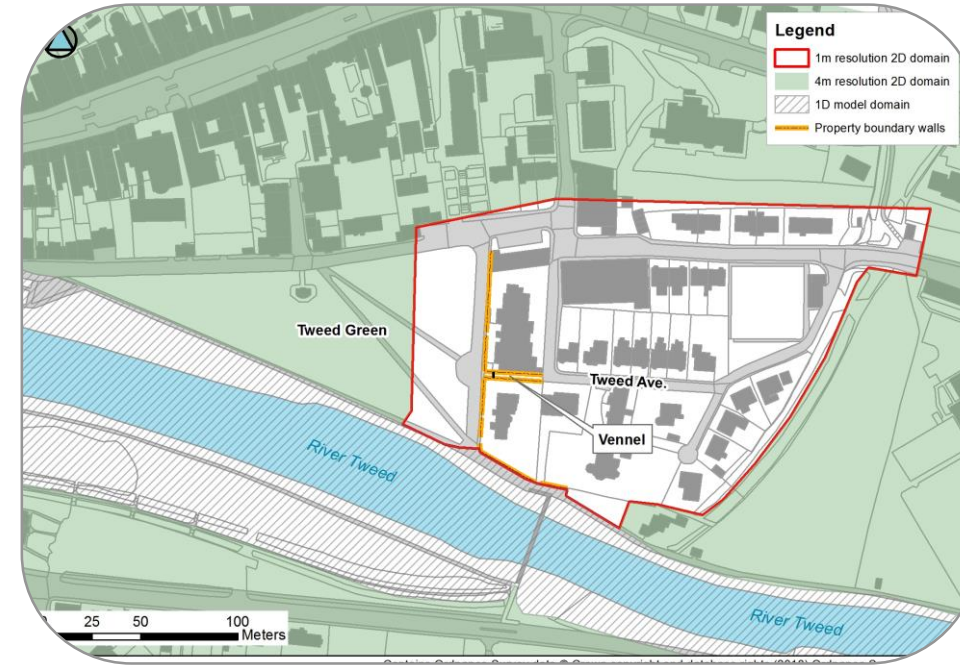
Asset inspections

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.

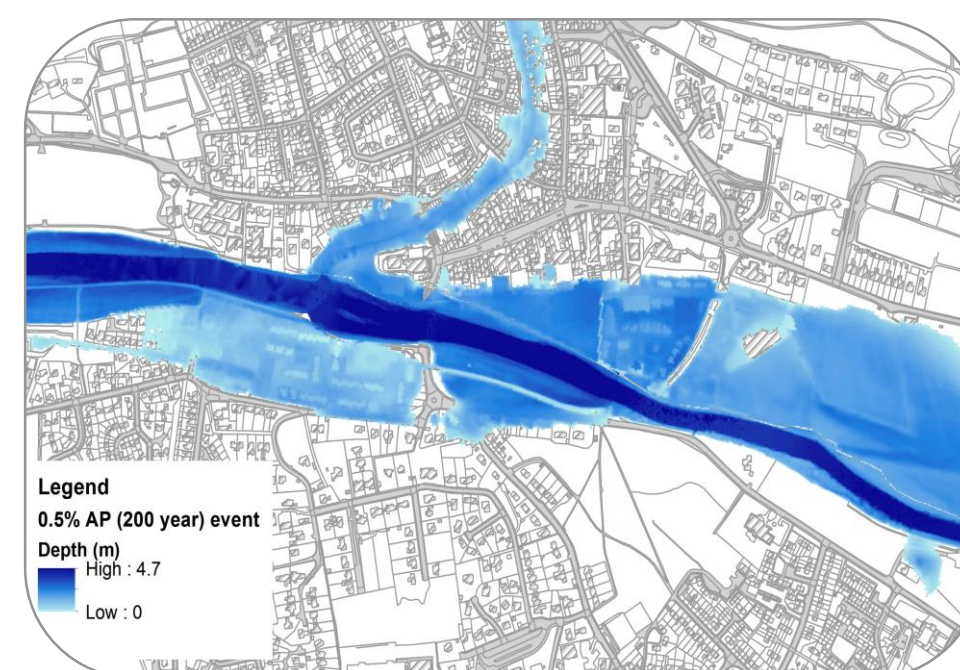
The models developed form a basis for assessing future flood levels, flood mitigation options, detailed design of schemes and the costs to deliver.



Hydrology



Modelling



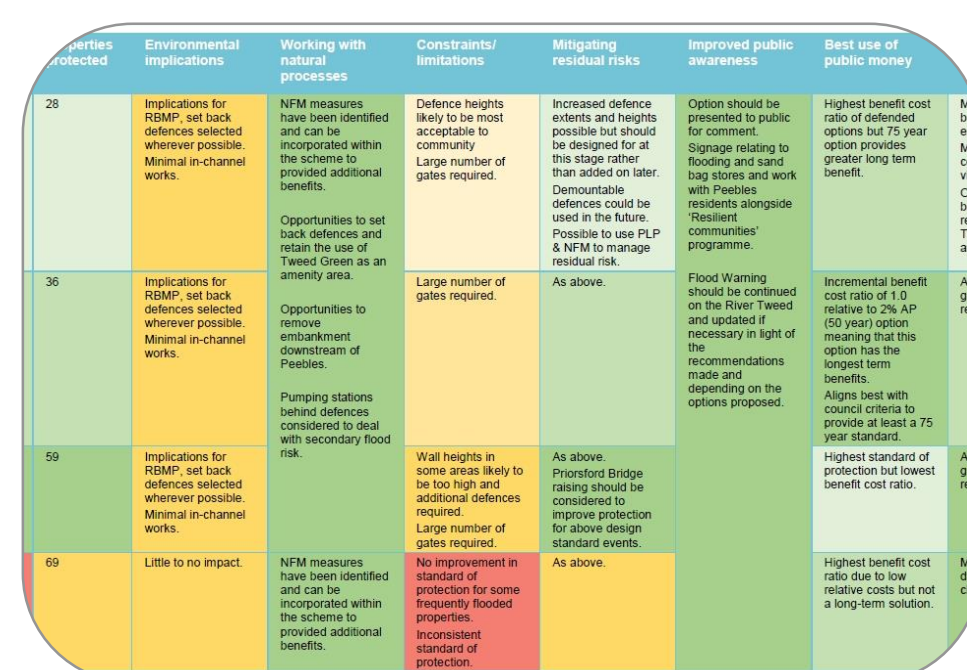
Flood Mapping

Return periods and annual probabilities

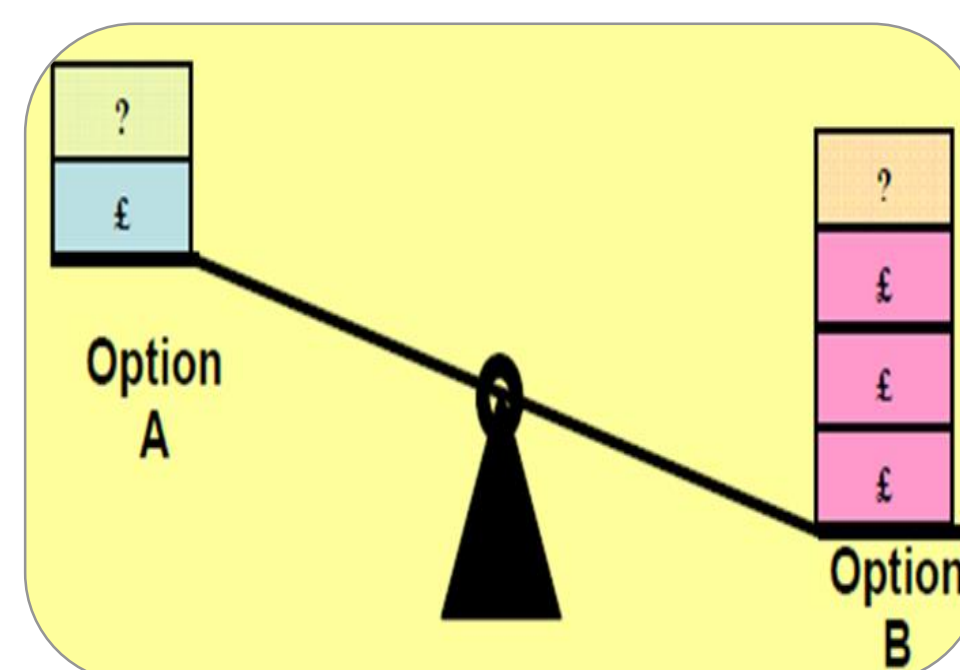
- When a river floods the severity of the flood is known as a 1 in x year flood. This terminology represents the probability of that event occurring in any year.
- For reference, the December 2015 event (Storm Frank) on the River Tweed in Peebles had a 1 in 55 chance of occurring in any year.
- This 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.



Properties at risk

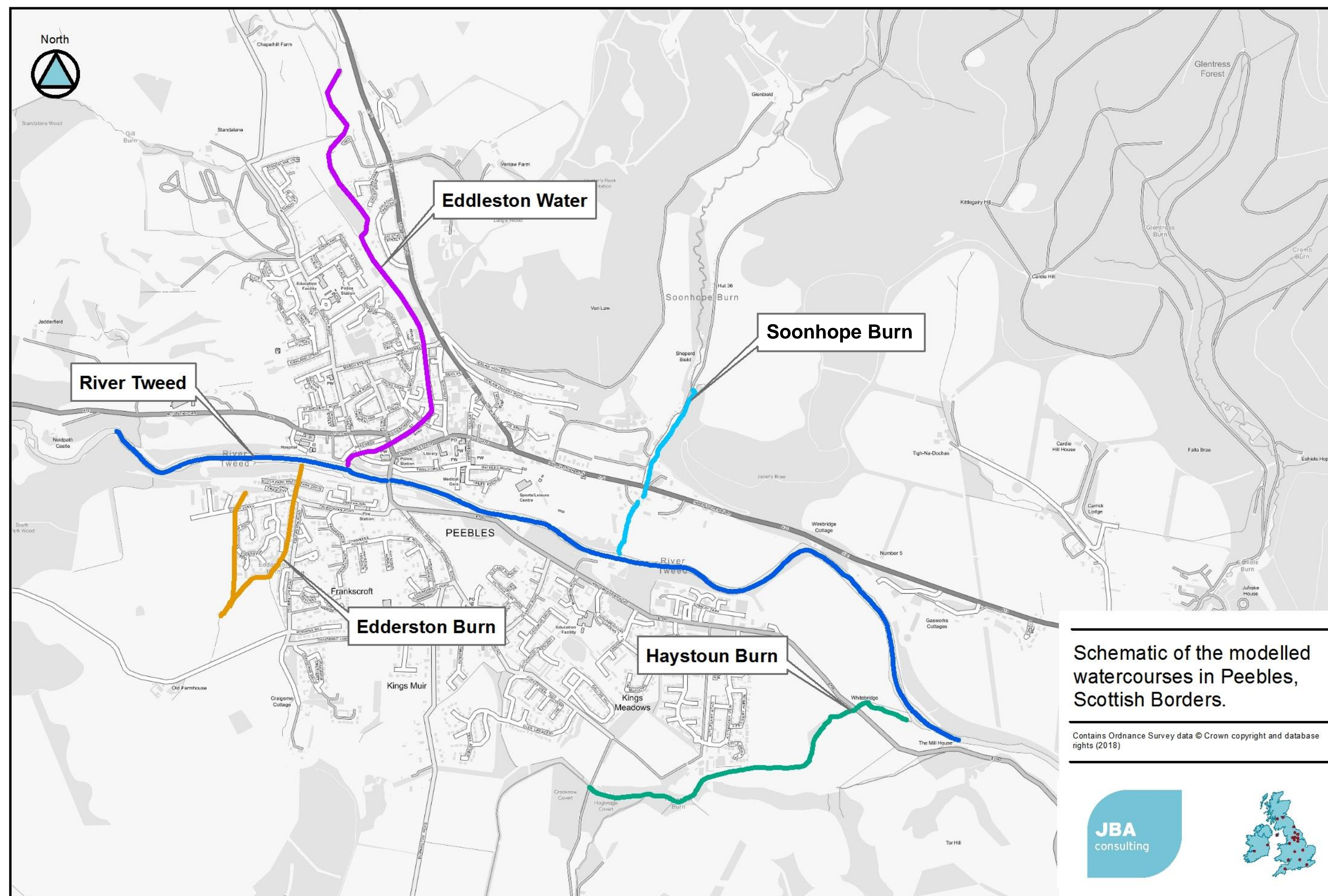


Options Appraisal



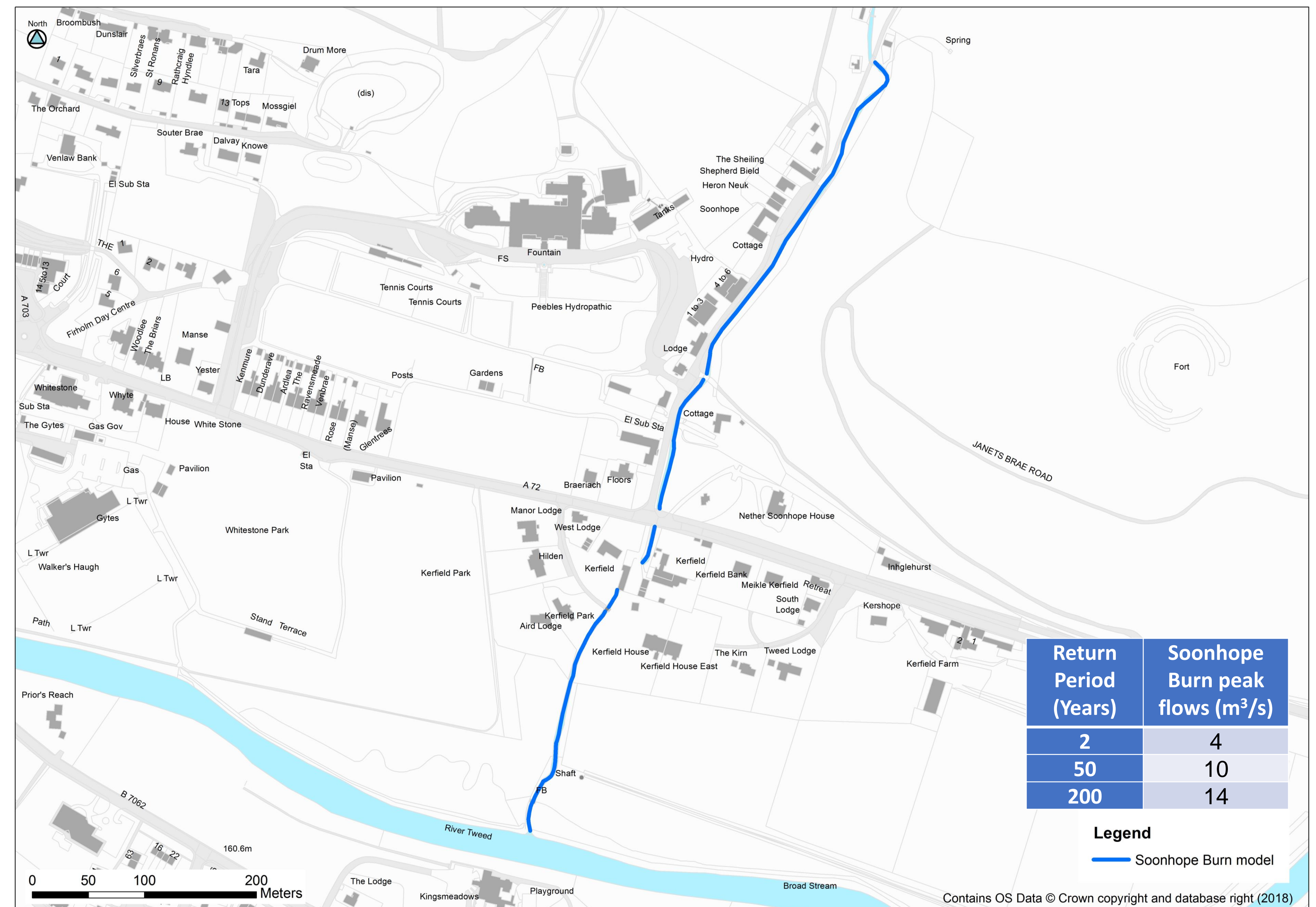
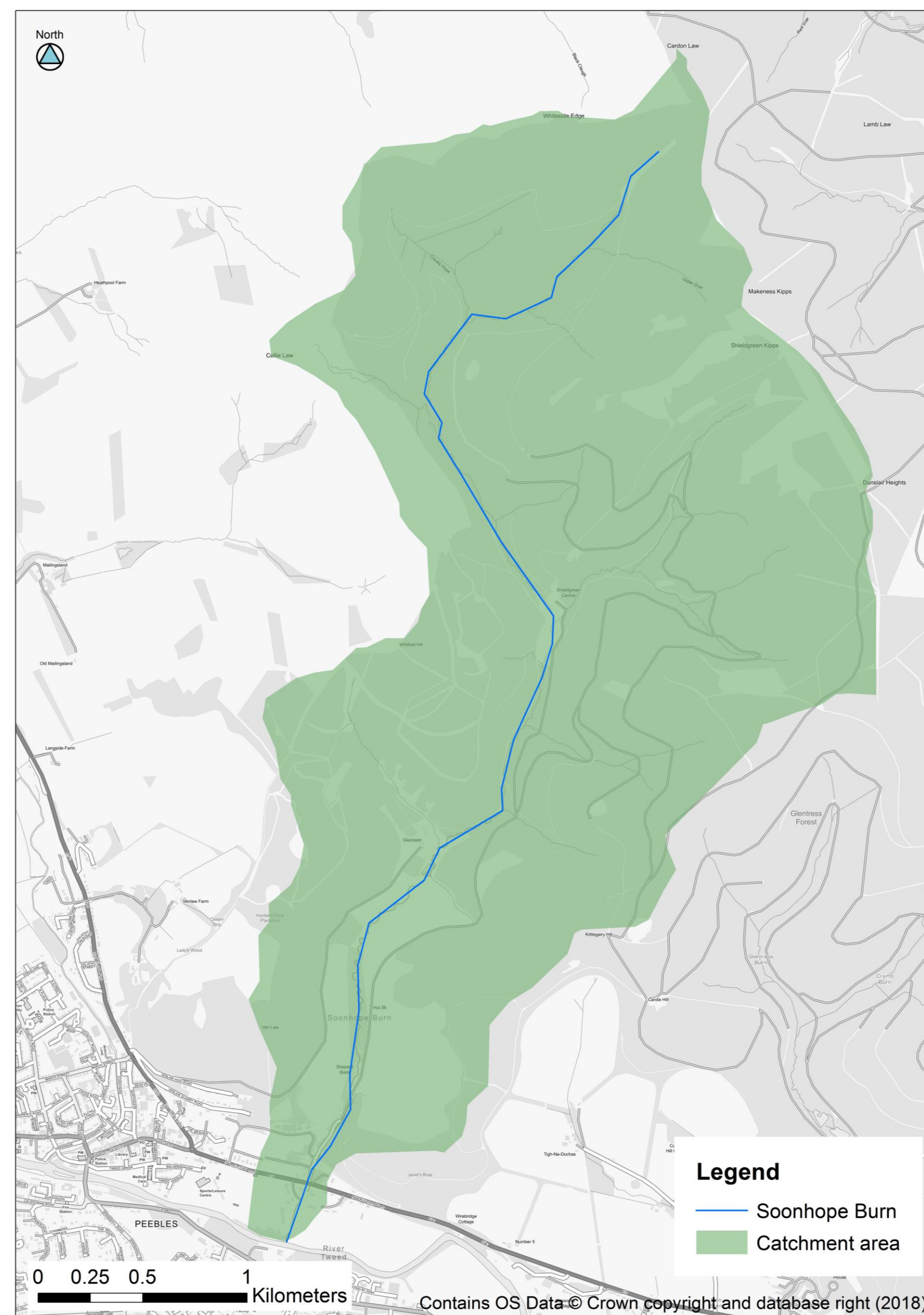
Cost-Benefit

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 700km² followed by the Eddleston Water (70km²), Haystoun Burn (23km²), Soonhope Burn (9.5km²) and finally the Edderston Burn with a catchment area of under 2km². 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.

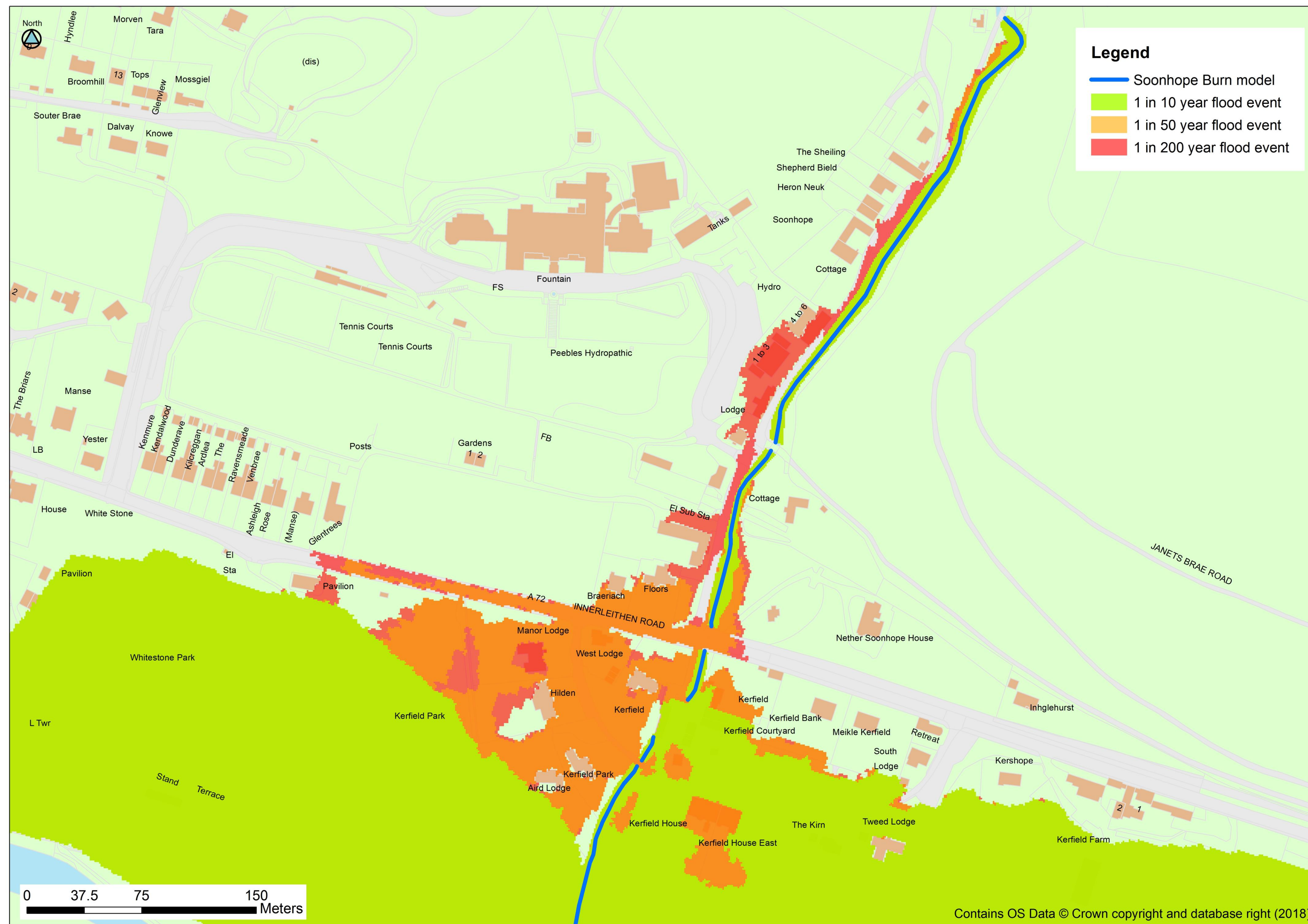


The Soonhope Burn has a catchment area of 9.6km² flowing from a source in Glentress forest past holiday huts and alongside properties on Hydro Drive before passing under the A72 and beneath Kerfield Cottage and into the River Tweed. The Soonhope Burn was modelled from downstream of the holiday huts to its confluence with the River Tweed. The figures below show the catchment and the length of modelled channel.

We have found no evidence of prior flooding on the Soonhope Burn.



Flood mapping – Soonhope Burn



Property Type	Number at Risk (1 in 200 year flood)
Residential	14
Commercial	1

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 put into 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 Soonhope Burn

Out of bank flow paths, key structures and constraints were identified. Out of bank flood flow is expected to leave the burn along Hydro Drive and could enter properties if river levels are high enough. The model predicts that water could back up behind the A72 road bridge and the Kerfield Cottage culvert. This area is the primary location of the flood risk and where flood depths are likely to be greatest. As floodwater reaches the River Tweed floodplain there is expected to be general flooding of the agricultural land.



Floodplain flows



Constricting structures

Has this flow mechanism been seen before?

There are no reports of flooding from the burn but the model suggests that water could get onto Hydro Drive and ultimately the A72.

Properties, particularly downstream of the A72, are at risk from this floodwater as it flows off the roads.

Soonhope Burn Options appraisal – M

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 Soonhope Burn.
- **Resilience Measures** - Unlikely to be economically or socially viable.
- **Watercourse Maintenance** – Council should continue the scheduled maintenance regime and carry out remedial works on walls and structures.
- **Natural Flood Management** – Some opportunities identified within the Soonhope catchment.
- **Storage** – Storage could feasibly reduce the peak flows on the Soonhope Burn.
- **Control structures** – Unlikely to substantially attenuate flows and would be impacted by the Special Area of Conservation status on the burn.
- **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 good 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** – Structure modification may be beneficial but is likely to be expensive due to the works requiring replacement of the bridge on the A72 and the removal of Kerfield Cottage to allow restructuring of the culvert.

Most desirable options

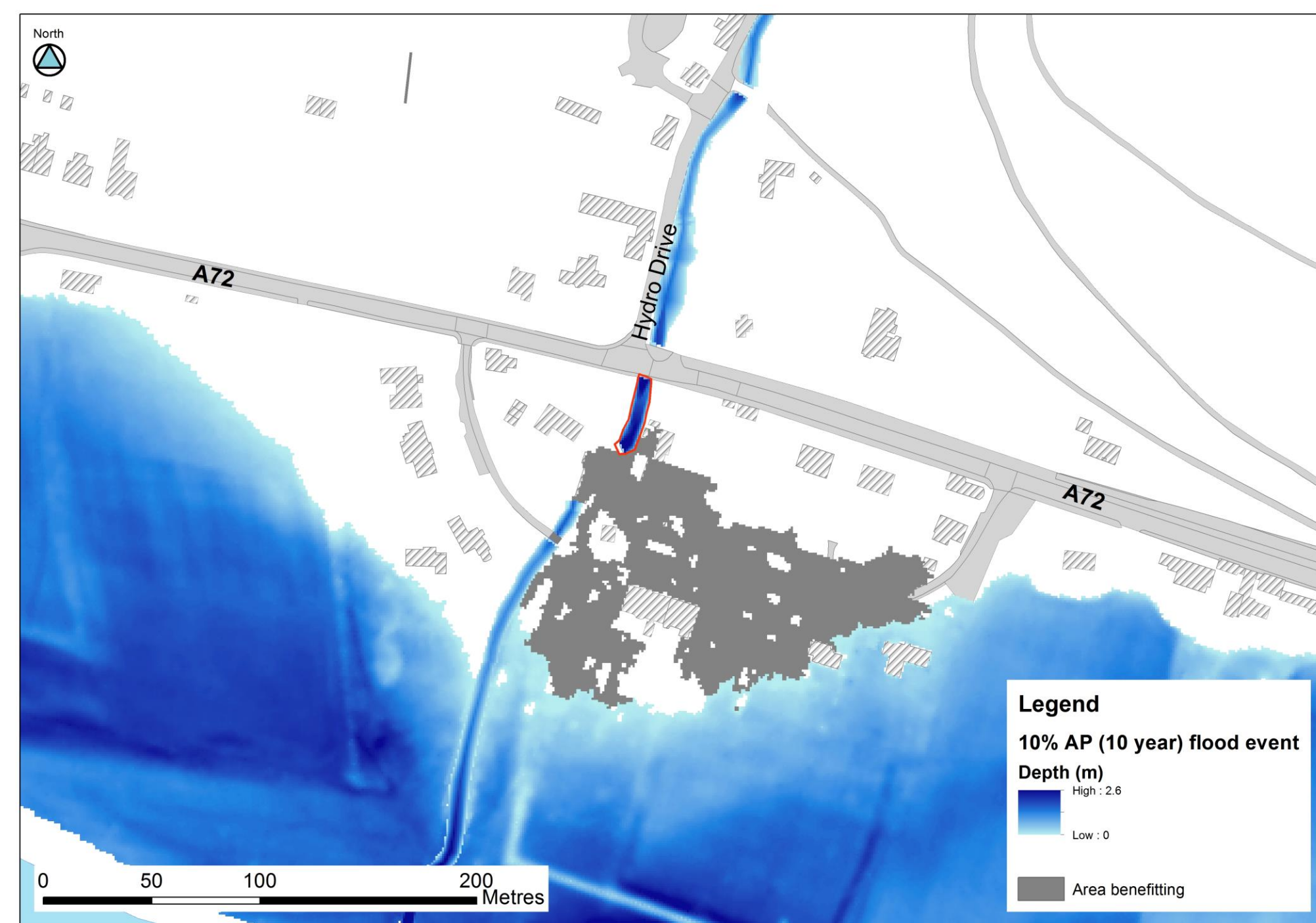
Good practice and partial solutions

Least desirable options

Soonhope Burn – Short Listed Options

Option 1: Direct flood defences (flood walls)

- This option provides a 10 year standard of protection to the properties to the north of Kerfield. No other properties are at risk.
- Wall heights up to 1.5m.
- Climate change adaptation could be possible but wall heights and extents would be greater.
- Estimated cost £0.2m
- Estimated damage avoided <£0.1m



Proposed flood defences



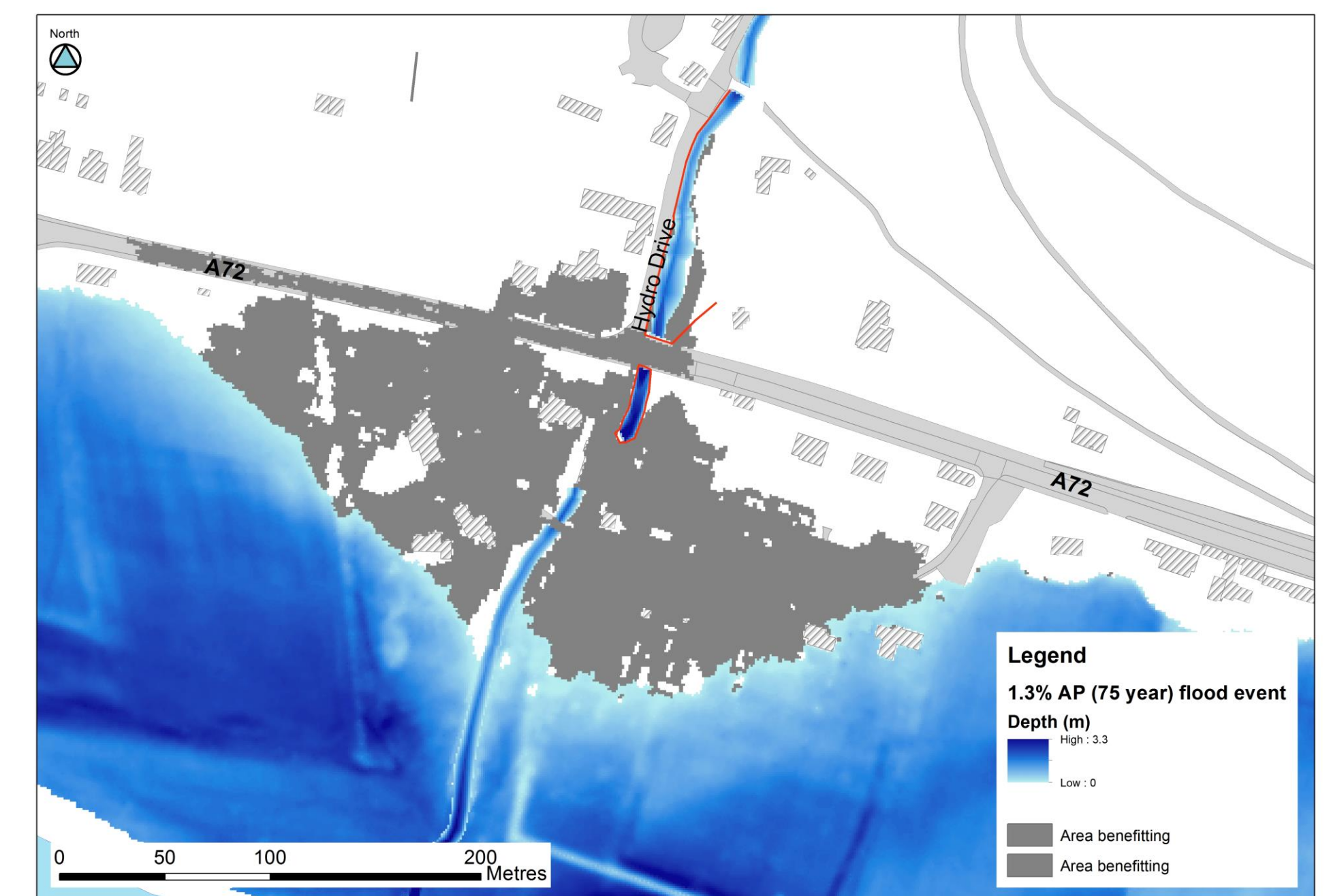
Typical example of a flood wall

Image compliments of Flood Control International

See adjacent technical drawings for further details for these options

Option 2: Direct flood defences (flood walls)

- This option provides a 75 year standard of protection. Mainly protecting properties surrounding the A72.
- Up to 1.6m high walls near the A72, reducing with distance upstream.
- Up to 1.55m high walls near Kerfield Cottage.
- Climate change adaptation could be possible but wall heights and extents would be greater.
- Estimated cost £1.7m
- Estimated damage avoided £0.4m



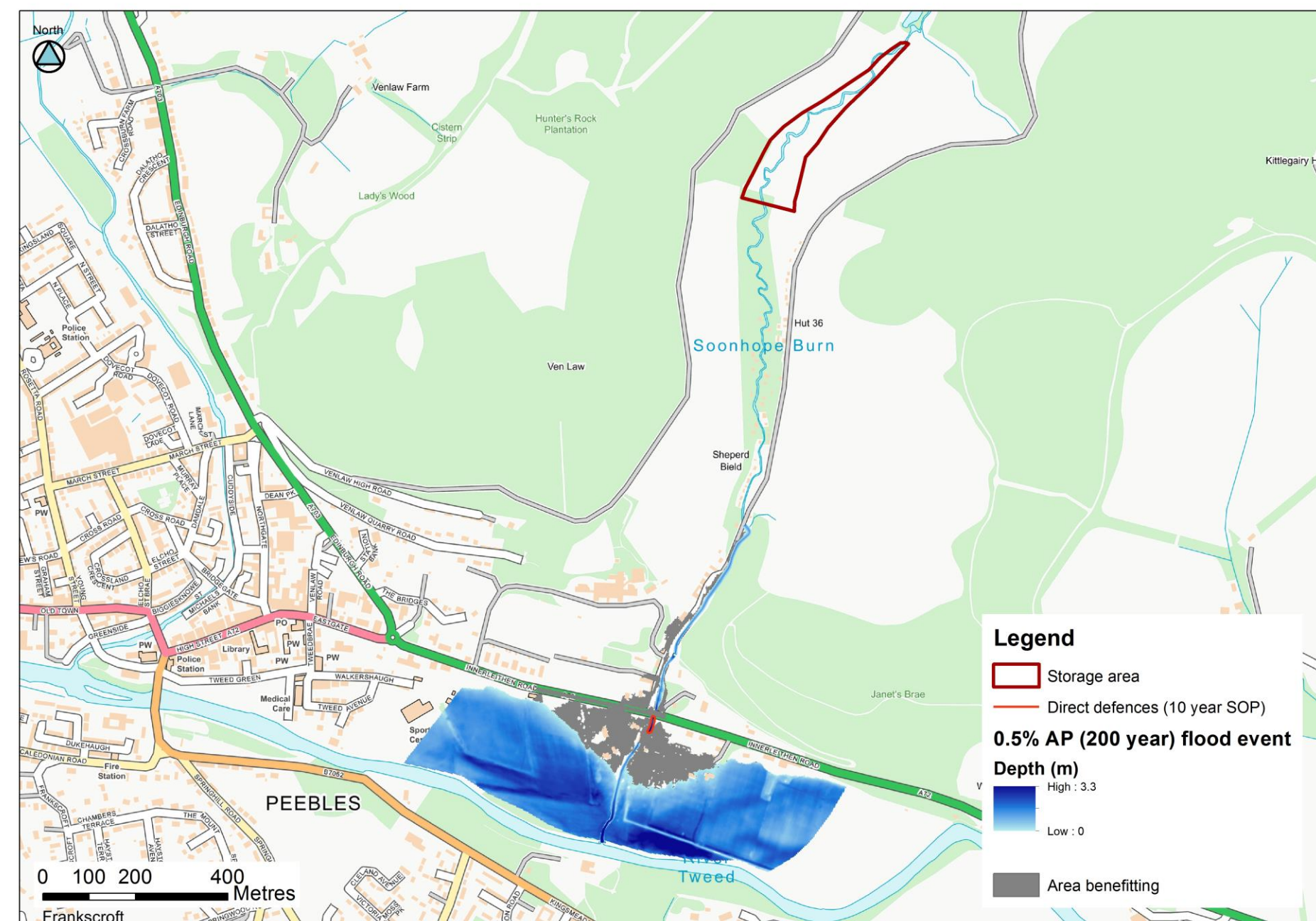
Proposed flood defences

Soonhope Burn – Short Listed Options

Option 3: Flood storage and direct flood defences

This option provides a 200 year standard of protection through creation of a storage embankment and control structure in the upper catchment and constructing raised walls downstream of the A72 as in Option 1.

- Wall heights up to 1.5m.
- Large reservoir in the upper catchment negatively places the town at higher risk in the event of dam collapse
- Negative impacts on the environment.
- Estimated cost £6.7m
- Estimated damage avoided £0.5m



Storage area and flood walls



Typical flood storage embankment

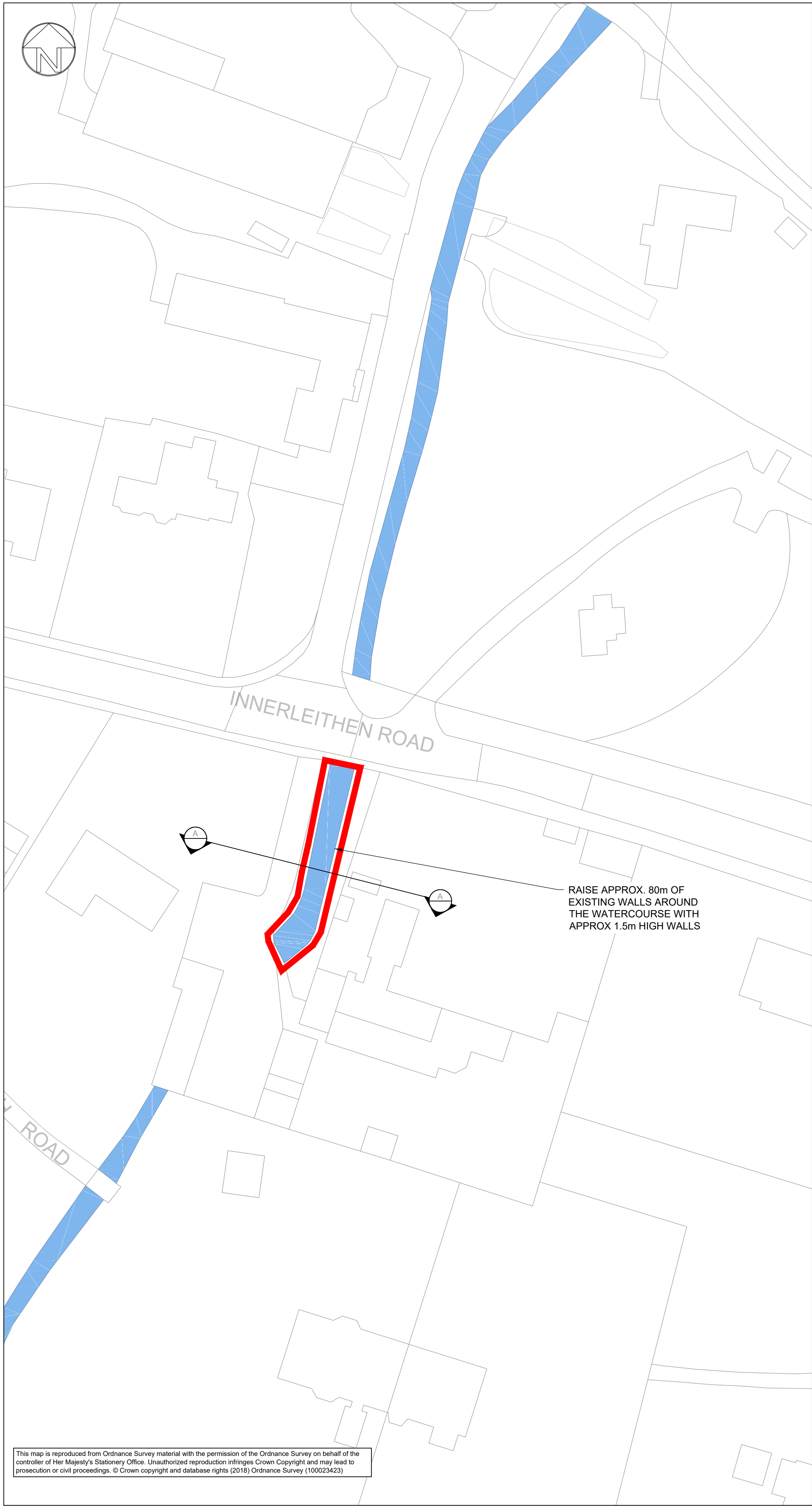
Option 4: Property Level Protection

- Automatic PLP installed in all 15 properties at flood risk to protect all properties against the 1 in 200 year flood event – a very high standard considering the low cost of implementing this option. PLP would involve surveying each property to identify water entry points and recommending appropriate products such as self-sealing doors and air vents as well as non-return valves on plumbing.
- Estimated cost £0.4m
- Estimated damage avoided £0.5m

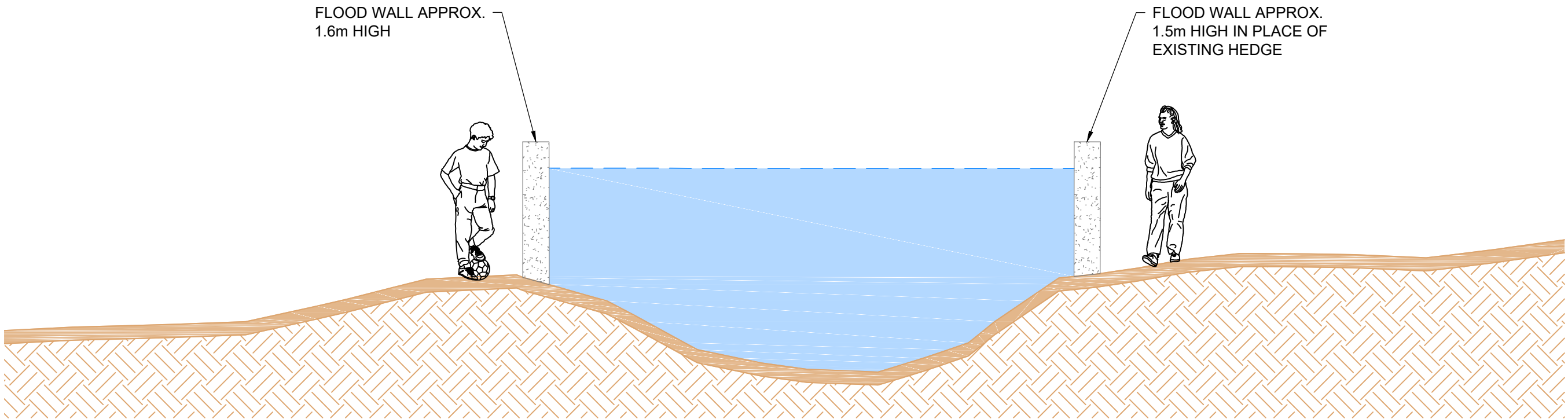


Typical examples of PLP

See adjacent technical drawings for further details for these options



SOONHOPE BURN PLAN
1:500



SECTION A-A: FLOOD DEFENCE WALLS
1:50

Peebles

Option 1: Soonhope Burn

10 Year Direct Defences

OPTOIN SUMMARY. Direct defences on both banks of the watercourse between the A72 bridge and the Kerfield Cottage Culvert. Relatively quick win option to increase the standard of protection to a consistent level with that provided upstream. Option provides a 1 in 10 year standard of protection.

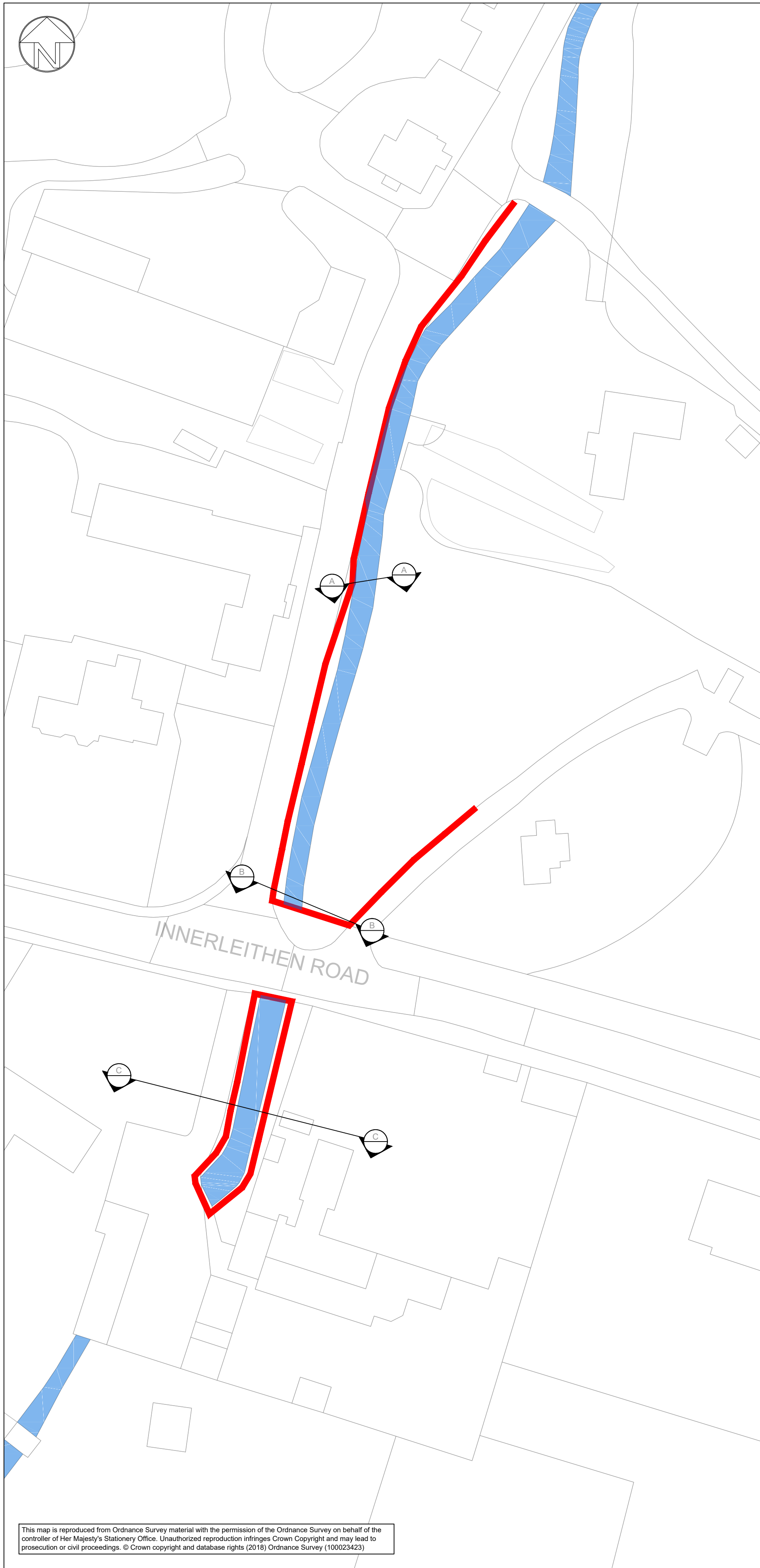
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Purpose of Issue					Status
Suitable for Coordination					S1

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Project	Borders Flood Studies	
Title	Peebles Soonhope Burn: Option 1 Direct Defences (10 Year SOP) for	
Client		

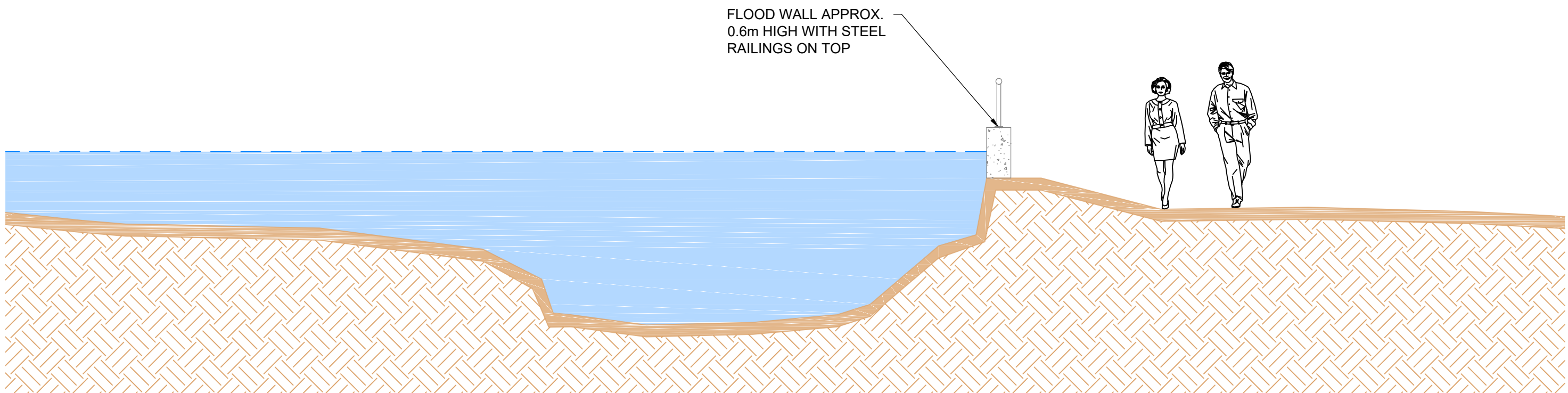
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Drawing Number AEM-JBAU-PB-SB-IM-C-1100			



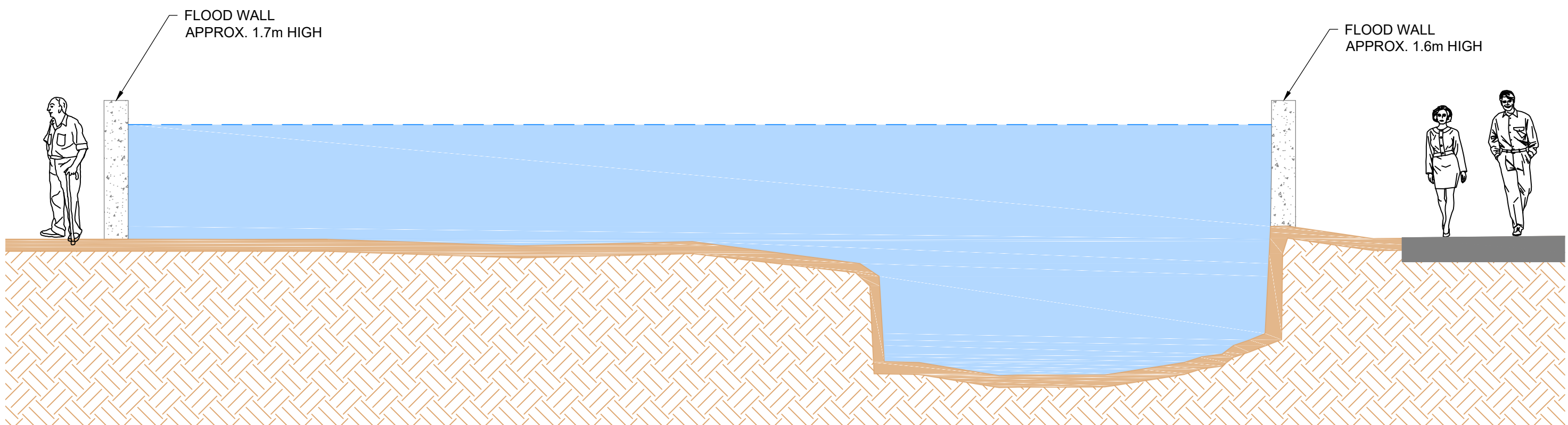
SOONHOPE BURN PLAN
1:500

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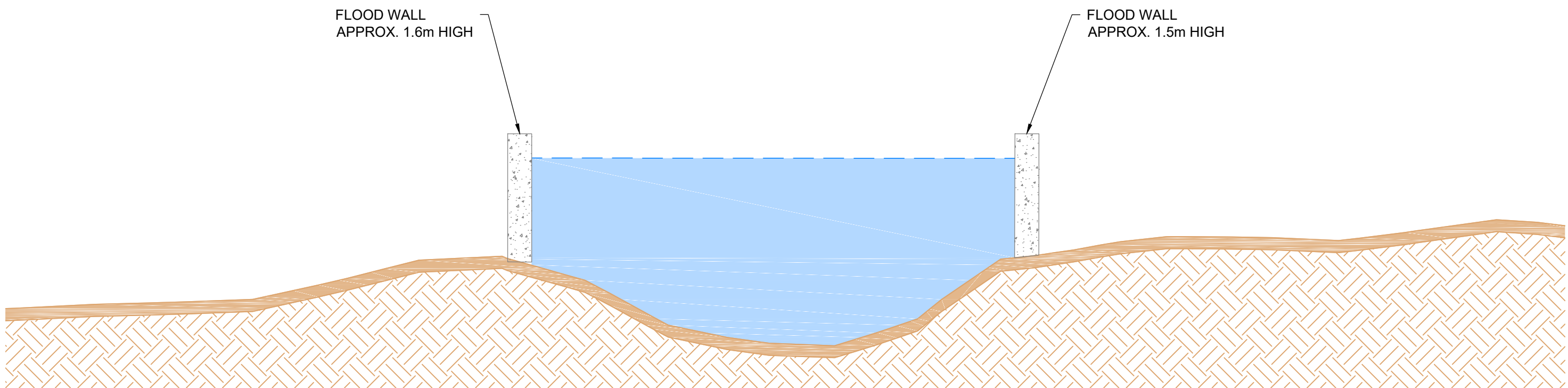
Peebles
Option 2: Soonhope Burn
75 Year Direct Defences



SECTION A-A: FLOOD DEFENCE WALLS
1:50



SECTION B-B: FLOOD WALLS UPSTREAM OF A72
1:50



SECTION C-C: FLOOD DEFENCE WALLS NEAR KERFIELD COTTAGE
1:50

OPTOIN SUMMARY. Replace wall on right bank between upstream access bridge and A72. Also replace A72 bridge parapet with higher wall and extend to high ground on the left bank. Walls raised between A72 and Kerfield Cottage Culvert. Higher defence standards would require wall heights that are unlikely to be visually acceptable.

Comments					
Rev.:	Date	Drawn	Designed	Checked	Approved
Client Approval					
A - Approved					
B - Approved with Revisions					
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Purpose of Issue				Status	S1
Suitable for Coordination					

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Project

Borders Flood Studies

Title



Peebles

Soonhope Burn: Option 2

Direct Defences (75 Year SOP)

for

Client



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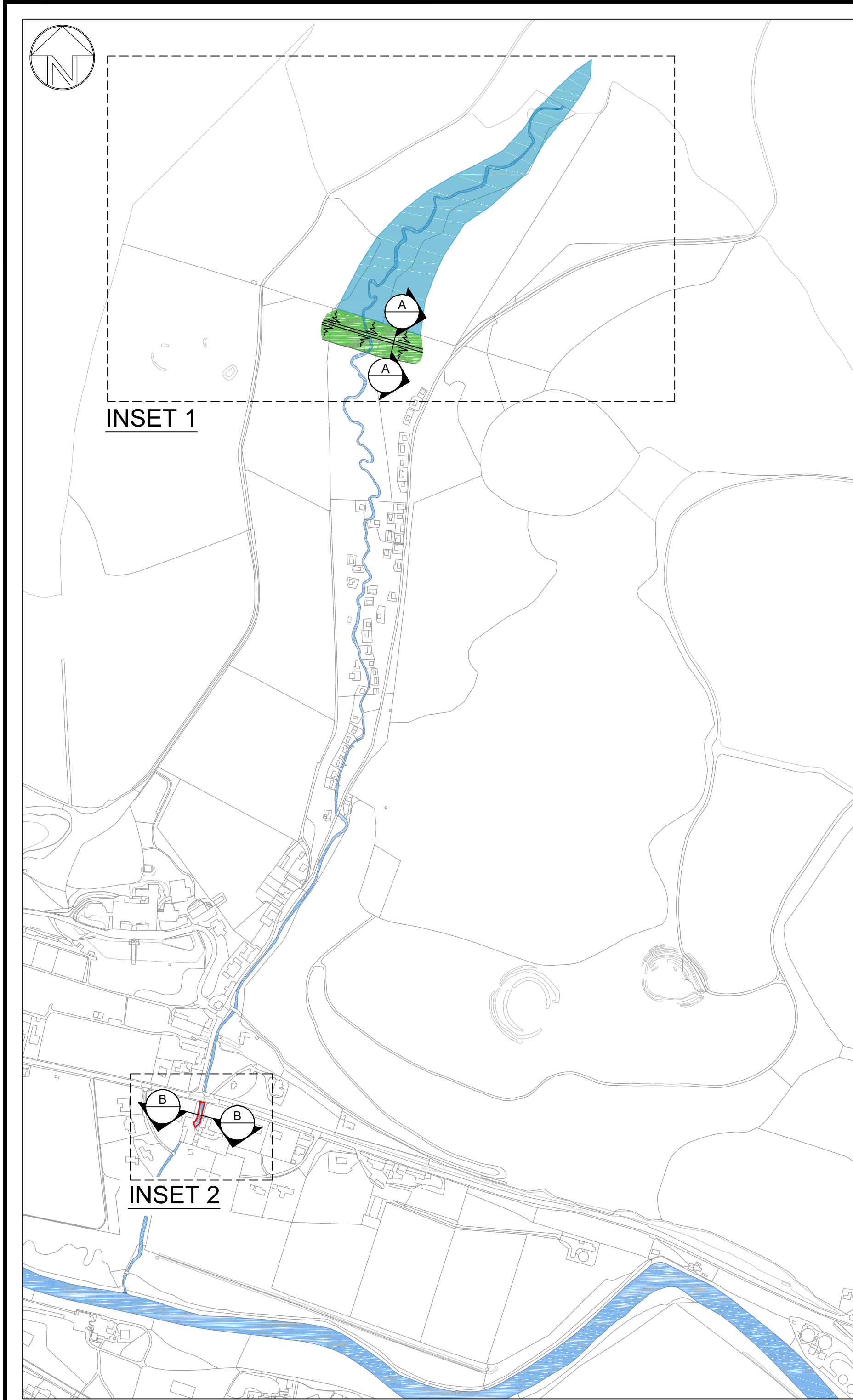
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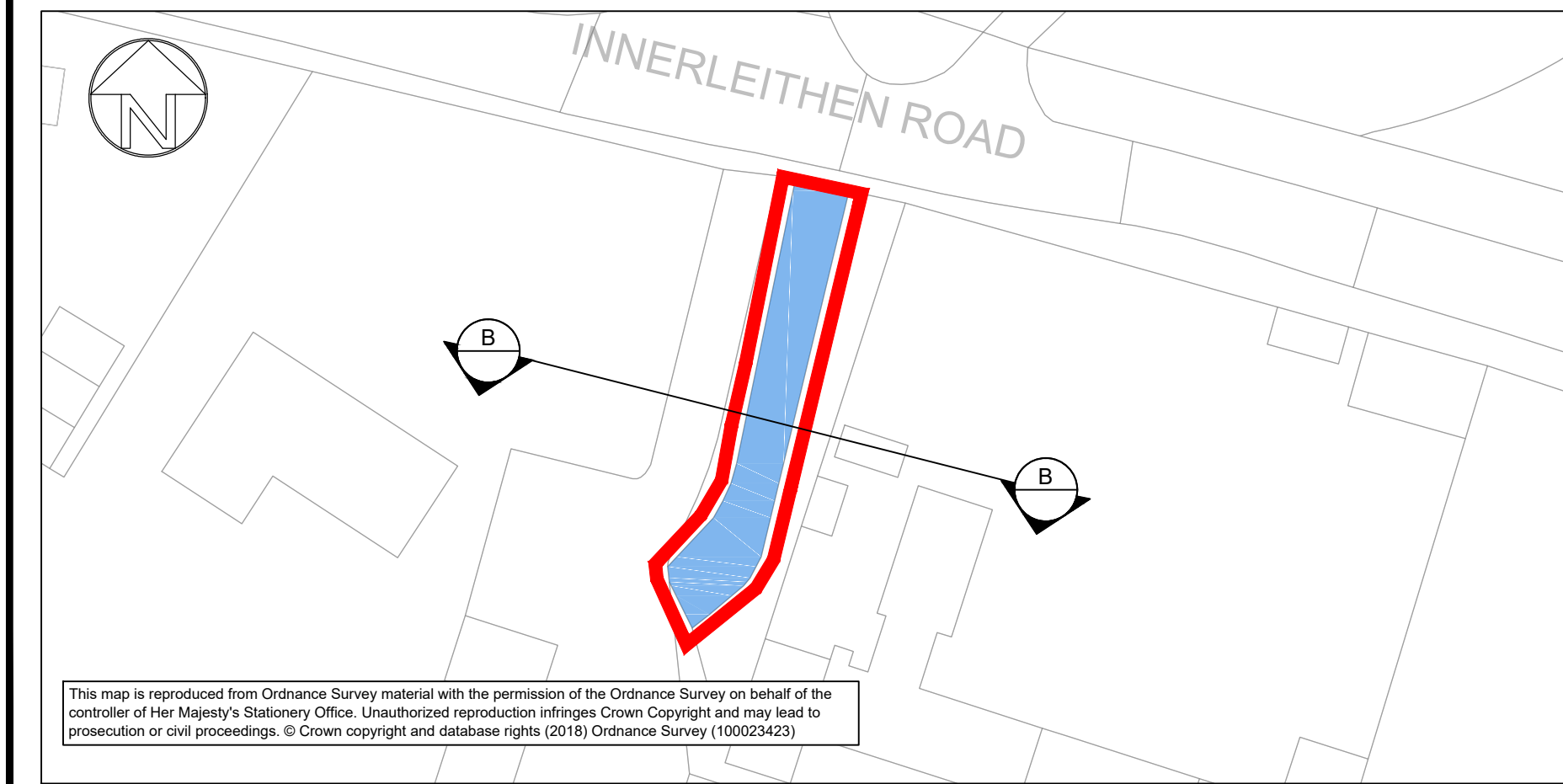
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Revision

P02



SOONHOPE BURN KEY PLAN
1:5000

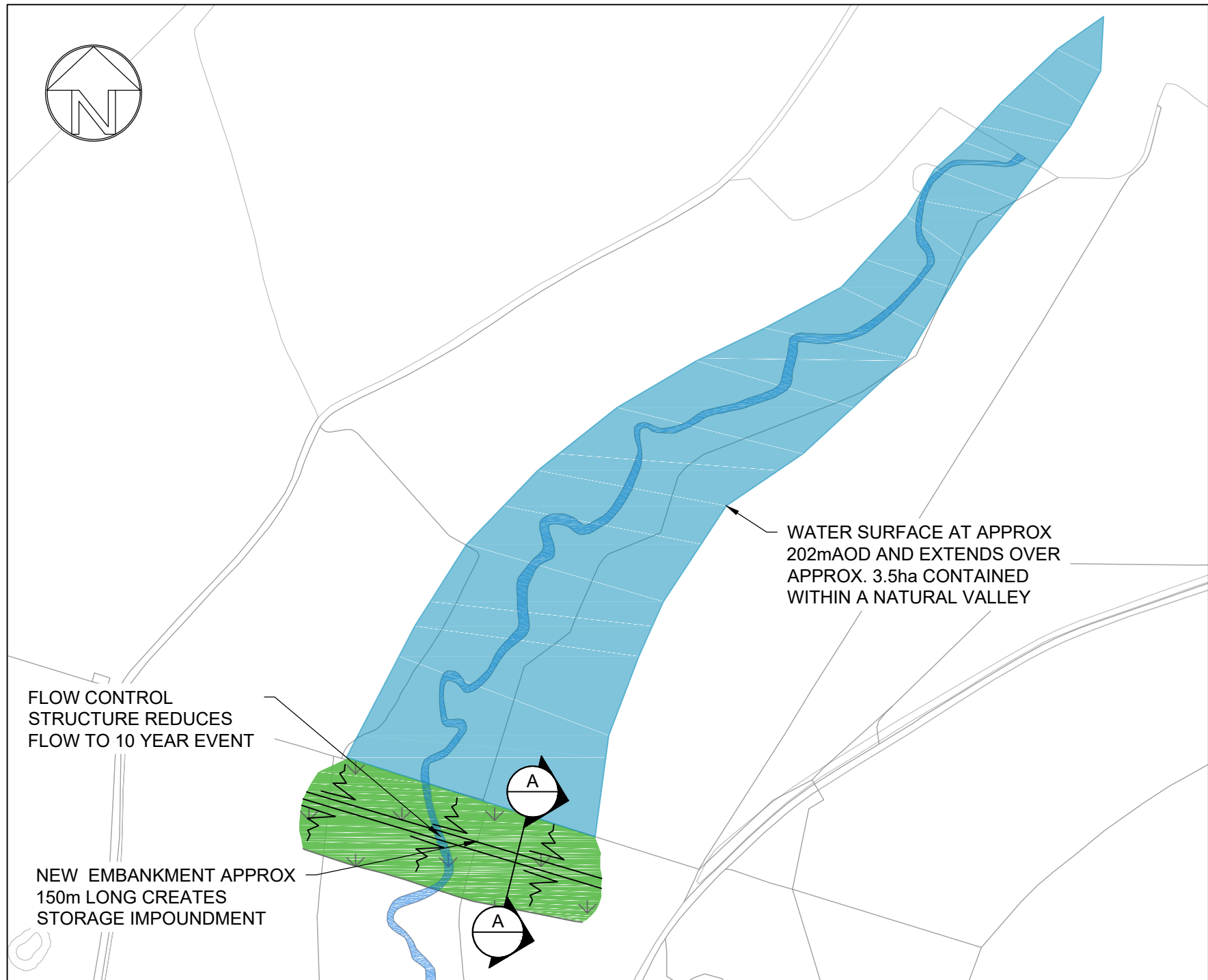


INSET 2: PLAN OF DIRECT DEFENCES
1:500

Peebles

Option 3: Soonhope Burn

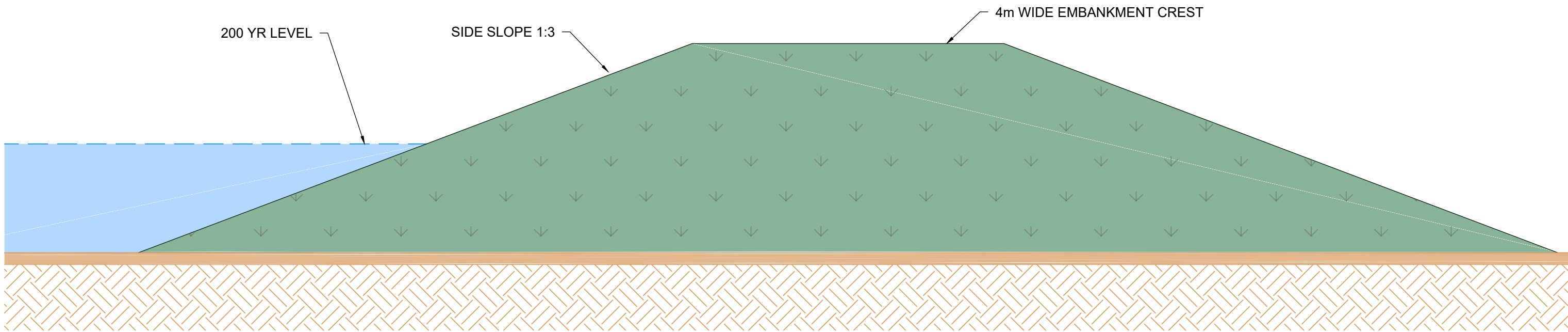
200 Year Upstream Storage and Direct Defences



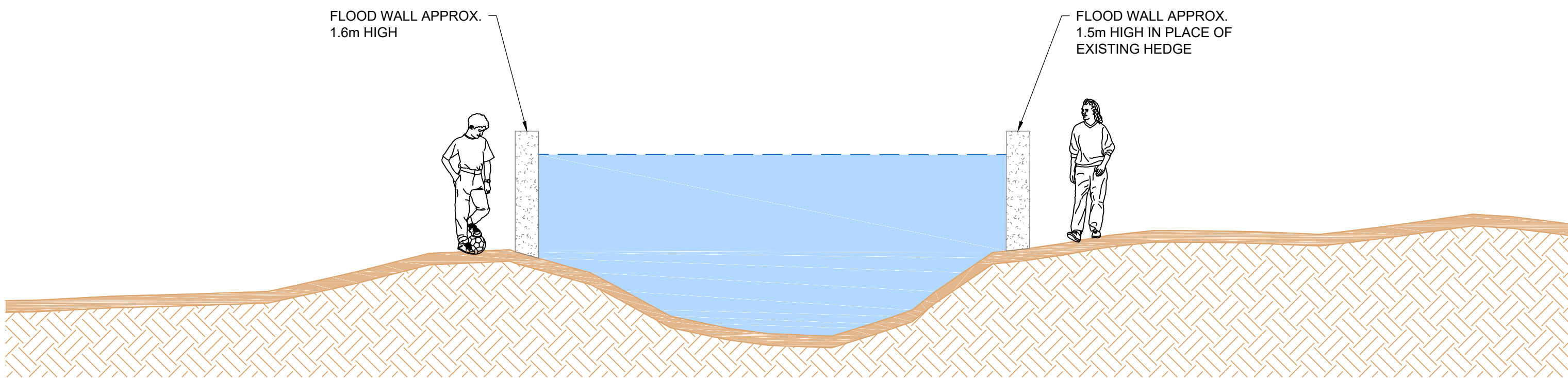
INSET 1: PLAN OF STORAGE IN UPPER CATCHMENT
1:2500



VIEW OF PROPOSED
STORAGE LOCATION



SECTION A-A
EMBANKMENT CROSS SECTION
1:50



SECTION B-B: FLOOD DEFENCE WALLS
1:50

OPTOIN SUMMARY. Construction of embankment to create upstream storage and attenuate flow to the 1 in 10 year flood downstream. Residual risk to be mitigated as per Option 1 with replaced flood walls on both banks between the A72 bridge and the Kerfield Cottage Culvert.


Comments					
Rev.:	Date	Drawn	Designed	Checked	Approved
Client Approval					
A - Approved					
B - Approved with Revisions					
C - Do Not Use					
Purpose of Issue				Status	S1



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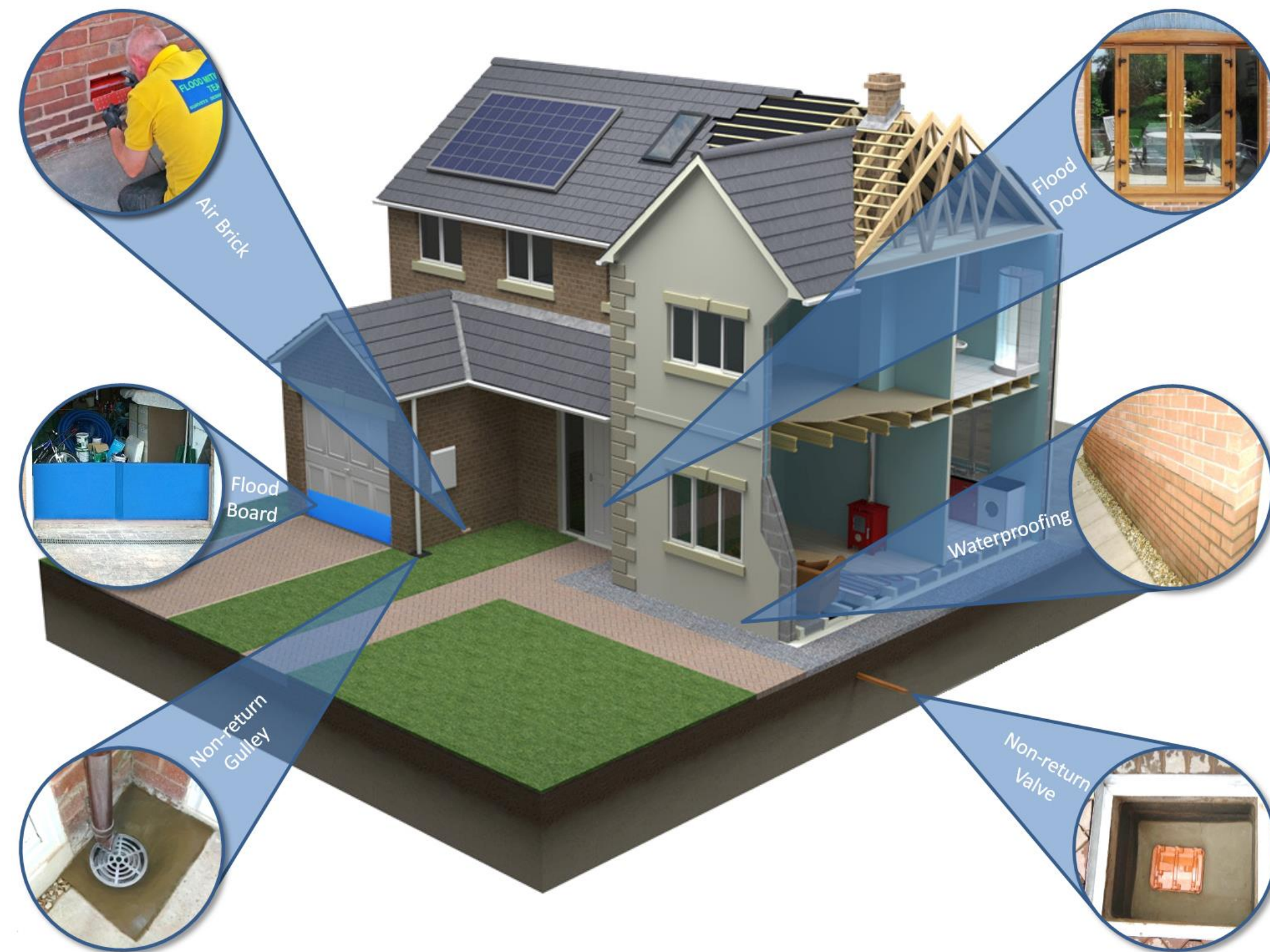
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Project		Borders Flood Studies	
Title		Peebles Soonhope Burn: Option 3 Direct Defences with flood storage (200 Year SOP) for	
Client		<div><div><div>M</div><div>MOTT MACDONALD</div></div><div><div>M</div></div><div></div></div>	
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Project Number: 2017s5526			
Drawing Number		Revision	P02
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Option 4 – Property Level Protection

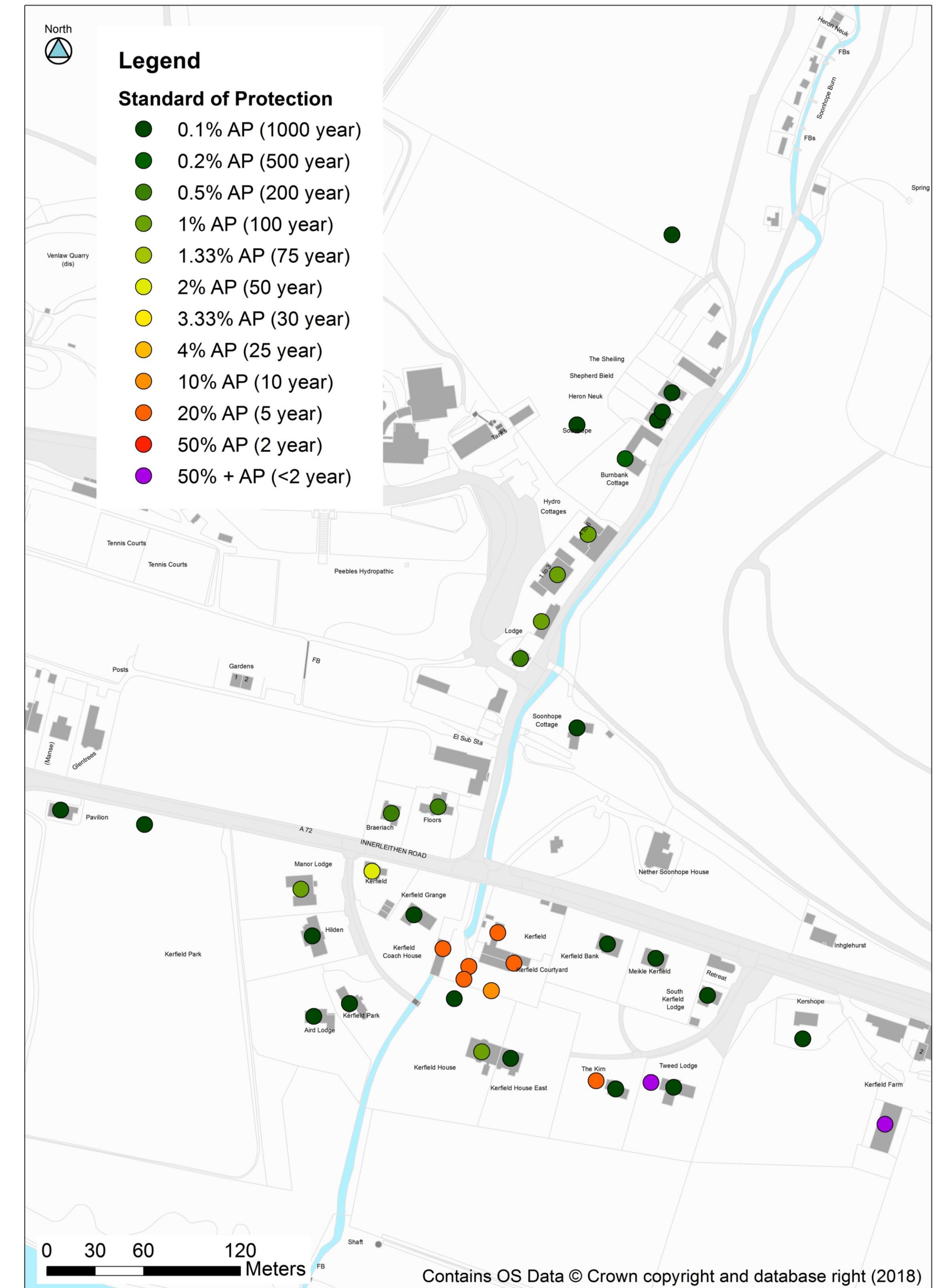
PLP is the last form of defence before water gets into a property. Automatic PLP measures mean that the property is always protected by, for example, watertight doors rather than having to insert waterproof door guards when floods are forecast. PLP can protect properties on the Soonhope Burn from the 1 in 200 year flood event.

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



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.

Preferred Option for Soonhope 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 (10% AP - 10 year)*	5	Little degradation in RBMP condition in this engineered reach but also no improvement.	Removal of the embankment at the downstream extent of the burn. NFM measures likely to reduce river flows on the burn so should be incorporated regardless of the option progressed.	Small scale engineering works with limited risk and disruption.	NFM may protect to some level of additional risk without the need to increase defence heights. Improving availability of hydrometric data likely to improve accuracy of flow estimates which may mean there is less residual risk than expected.	Options should be presented to public for comment. Signage relating to blockage of the A72 and Kerfield Cottage culvert and notifying public about sand bag stores and work with Peebles residents alongside 'Resilient communities' programme. SEPA should procure a river level gauge to provide some warning of rising water levels in the burn.	Not cost effective (BCR -0.2)
Option 2 - Direct Defences (1.33% AP - 75 year)	7	Minor RBMP impacts. In-channel works likely to be required upstream of A72. Arboricultural works required to mature trees to provide construction access (TPO's will need to be lifted).		Increased length of overall defence with greater disruption.			Not cost effective (BCR 0.2)
Option 3 - Storage and Direct Defences (0.5% AP - 200 year)	15	Artificial storage area in semi-natural moorland, loss of habitat.		Extensive intervention with implications for community.	Storage embankment could be raised to protect against climate change. NFM not likely to contribute due to storage area.		Not cost effective (BCR 0.1)
Option 4 - PLP (0.5% AP - 200 year)	15	Little to no impact		Relies on PLP at individual properties being maintained, possible issues with funding/ maintenance.	Little residual risk, only likely to be managed by construction of defences as per options 1 or 2.		Benefit cost ratio of 1.2, the only cost-effective option of those tested.

*Uncertainty in flow estimates means standard of protection may be higher than calculated.

Negative Neutral Positive

Preferred Options and recommendations

The preferred option for the Soonhope Burn is the PLP option due to it being the only option which is cost-effective. 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:

- Watercourse maintenance.
- Repair wall upstream of A72.
- Consider coarse debris screen within burn.
- Raise awareness of sandbag stores within Peebles.

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 Soonhope catchment include:

- Improve offline storage ponds in the upper catchment
- Woodland planting and allowing buffer strips alongside the river
- Construct debris dams and leaky bunds
- Prevent livestock from entering the watercourse.

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



Typical example of an offline storage pond



Typical example of in-channel debris barrier



Typical example of young woodland

Location and type of measures suggested for the Soonhope Burn catchment



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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

