Borders Flood Studies

How is flood risk managed by the Scottish Borders Council?

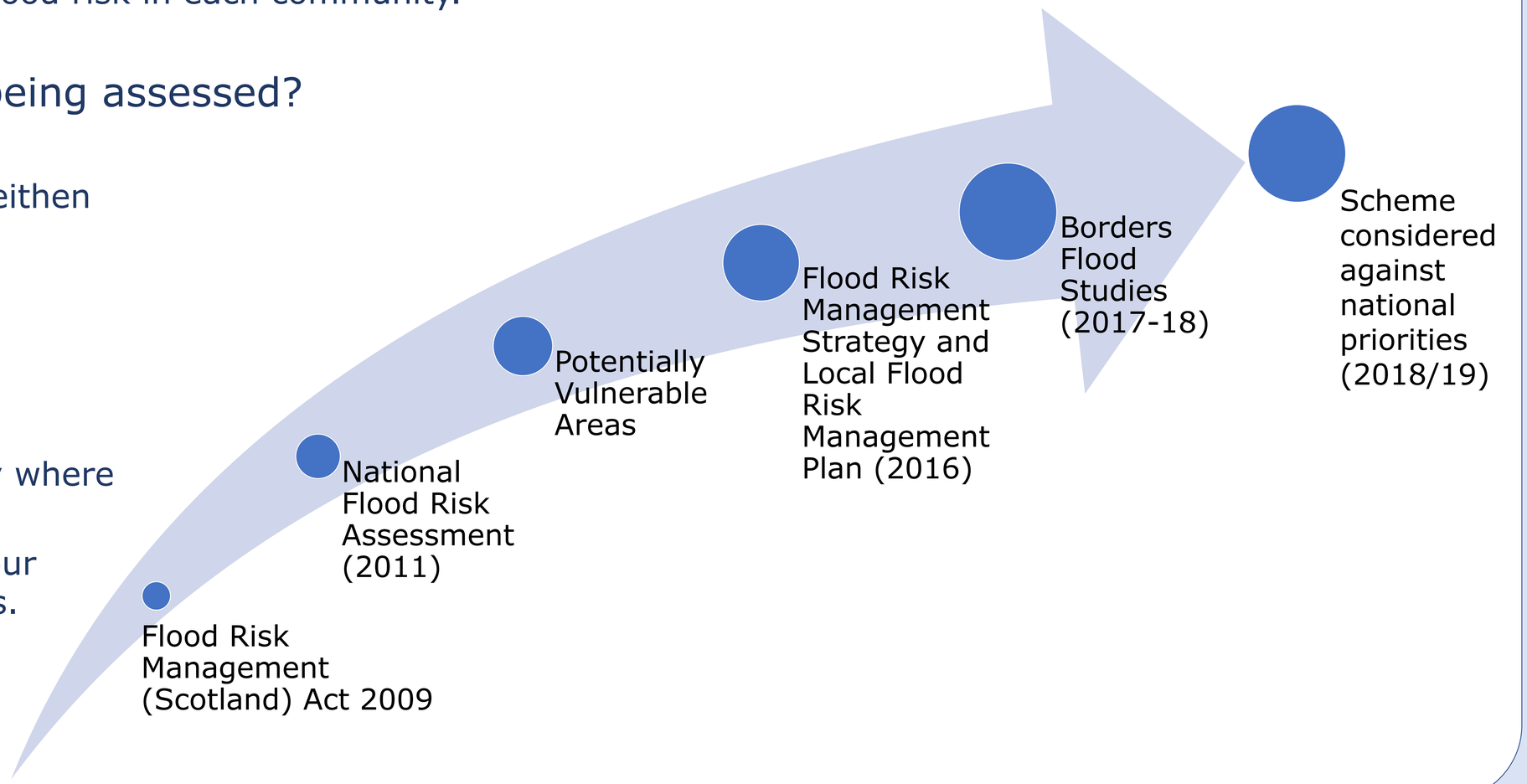
- The Flood Risk Management (Scotland) Act 2009 aims to prioritise flood mitigation across Scotland using a proactive and risk based process for assessing flood risk.
- This approach led to the preparation of SEPA's Flood Risk Management Strategies by SEPA and the Tweed Local Flood Risk Management Plan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

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

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?

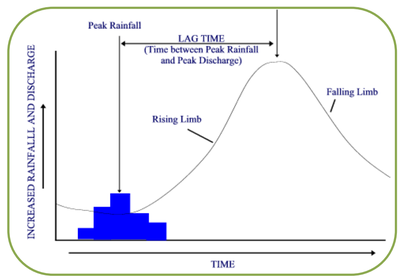
- Scottish Planning Policy requires new build properties to have a 200 year standard of protection
- This standard is accepted as low risk by the flood insurance companies.
- A higher standard of protection will mean the scheme will be considered more favourably by SEPA's scheme prioritisation making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

What has been done so far?

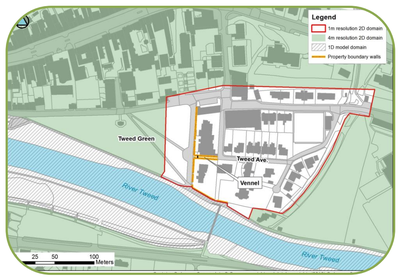
Flood Review

Topographic surveys

Asset inspections

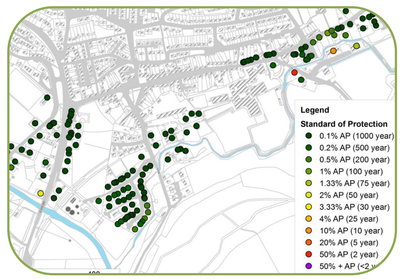


Hydrology

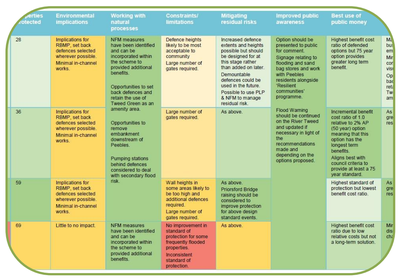


Modelling

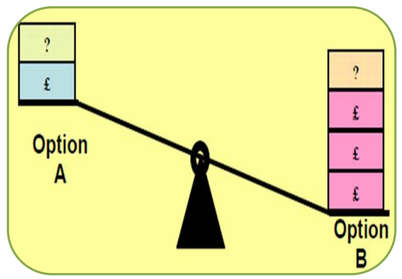
Flood Mapping



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) 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.

Flood Timeline

1948
Some properties flooded to a depth of 0.9m, one even to within 0.25m of ceiling level. Particularly affected properties around Mill Road such as Rhymers woollen mill.

Photo courtesy of YouTube user 'Chris ja', photo shows the October 2012 flooding on the Turfford Burn

1992
Flooding of 'AA Catering' on Station Road.

2003
Significant flood recorded on the Turfford Burn.

2015
Flooding to Church Street as a result from runoff from the north. Flooding similar to 2012 event and flooding to playing fields and school car park resulting in cars flooded.

1940 1950 1960 1970 1980 1990 2000 2010 2020

Photo courtesy of YouTube user 'Chris ja', photo shows the October 2012 flooding on the Turfford Burn

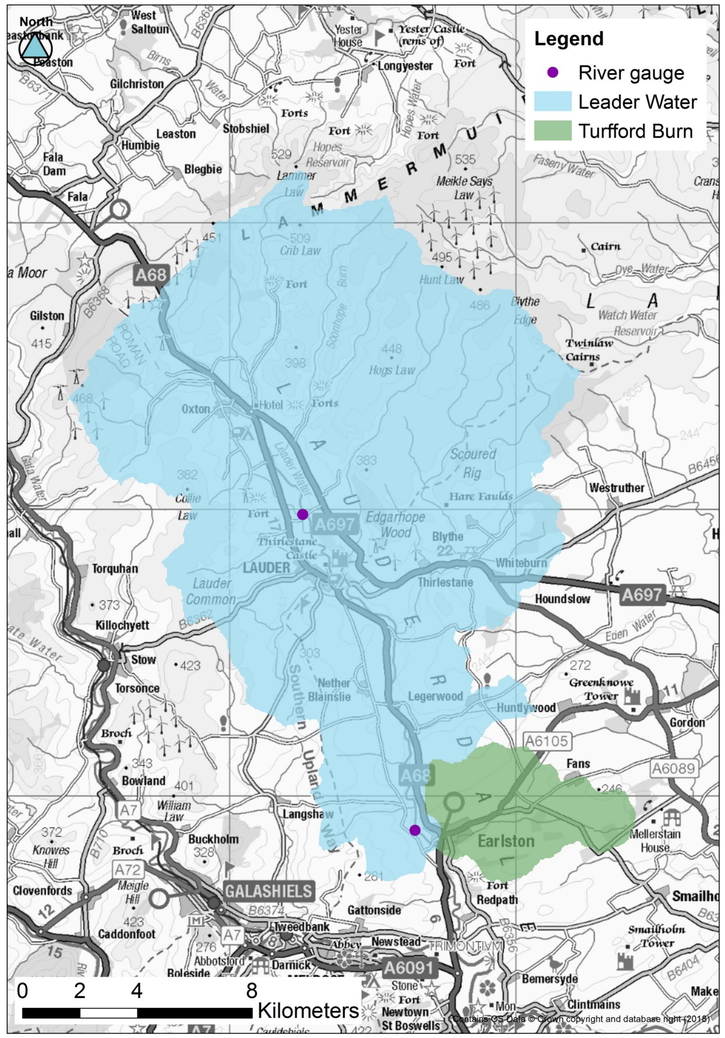
1984
Flooding to properties from the Leader Water.

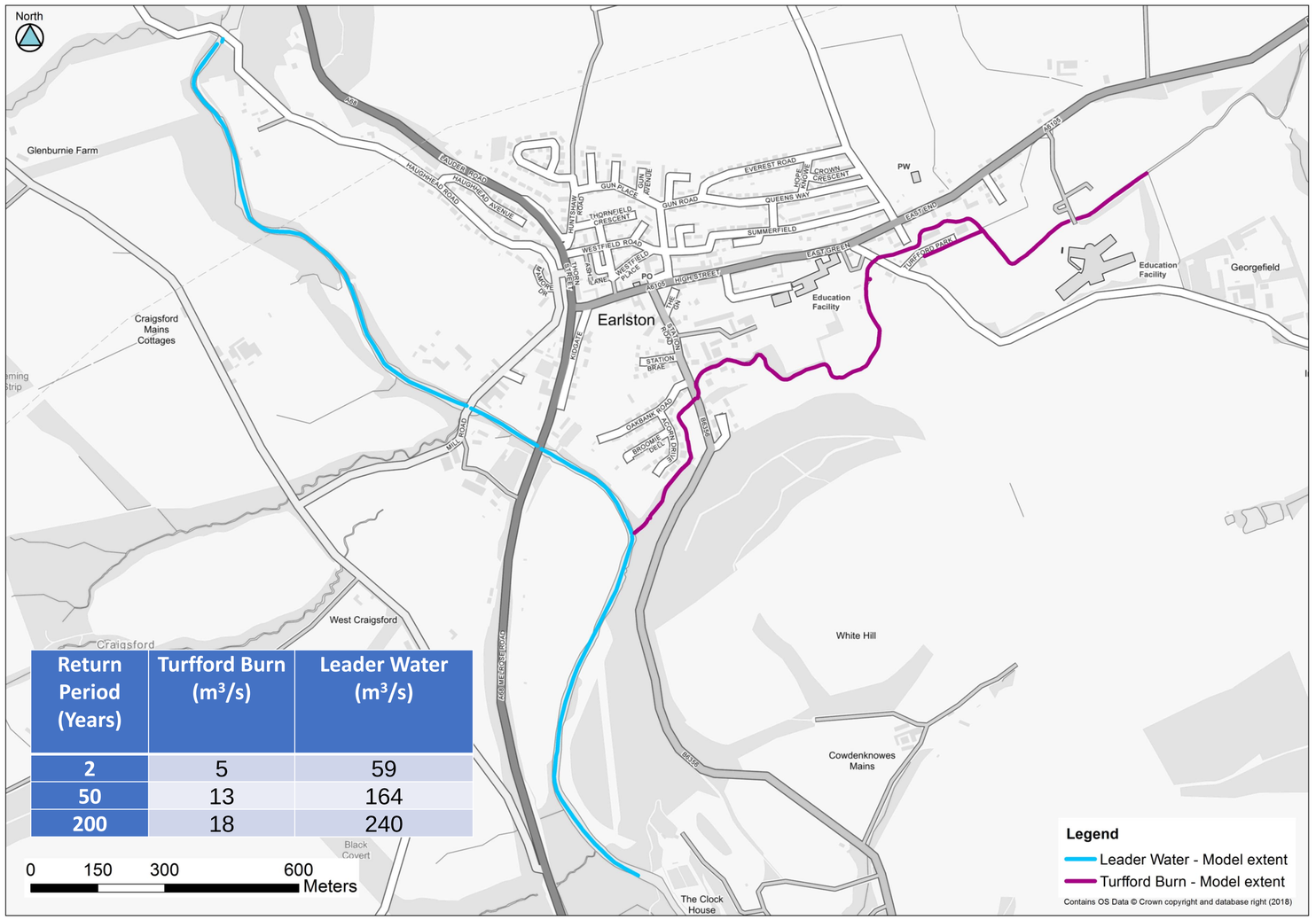
2002
Flooding to the grounds of Rhymers Mill Cottage (Leader Water) and Crossing House (Turfford Burn) as well as the Primary school grounds.

2012
Flooding to Georgefield Road, bridge and primary school playgrounds. Flooding of the pitches near Acorn Drive and high levels recorded on the Leader Water.

Catchments and watercourses

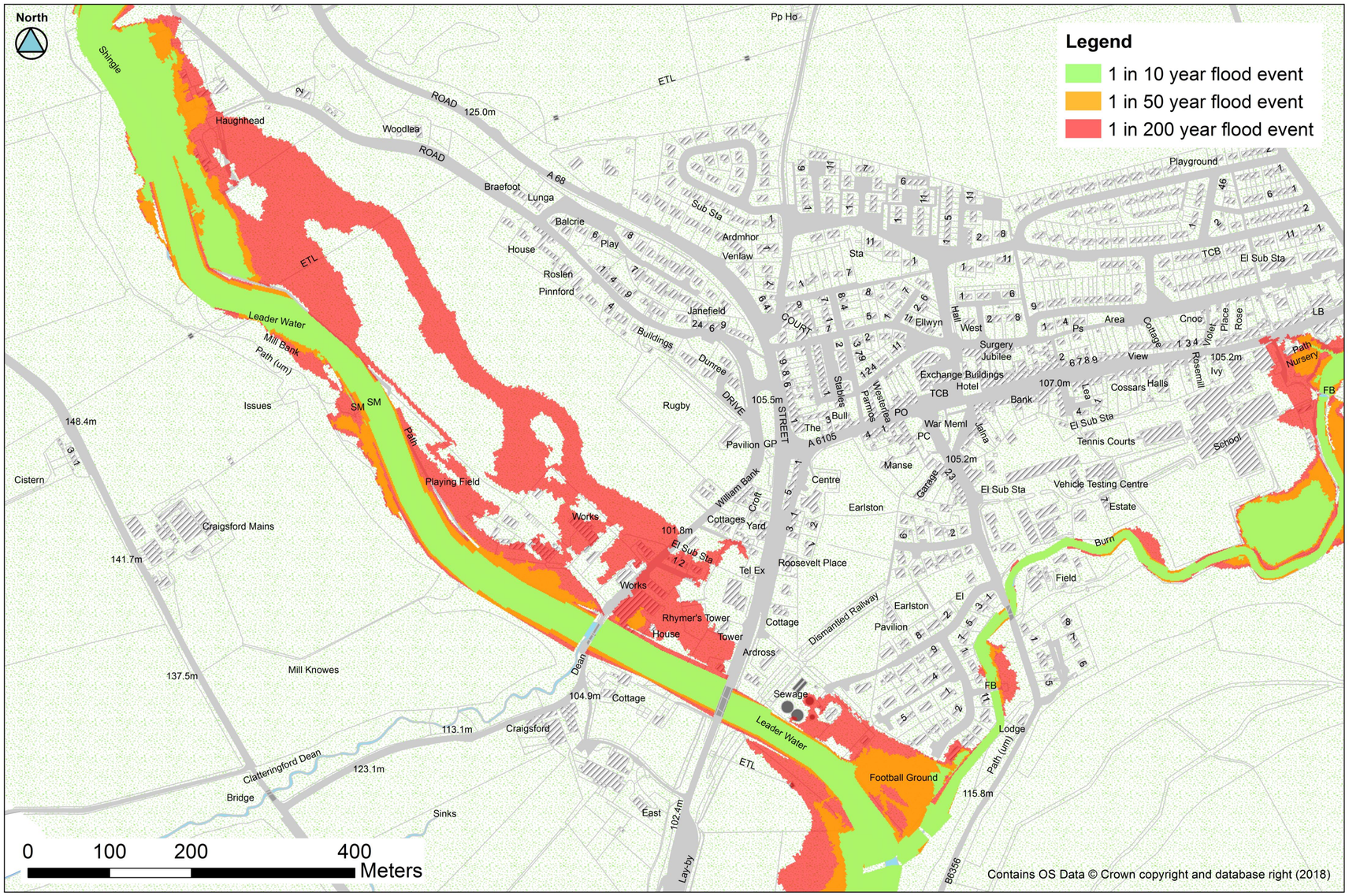
Earlston is at flood risk from the Leader Water and Turfford Burn. The Leader Water is the larger of the two watercourses with a catchment area of 270km^2. The Turfford Burn, with a catchment area of just 23km^2, is a small watercourse which features a flood diversion channel dating from the 1960's. The Turfford Burn is predicted to flood more frequently than the Leader Water. The figures below show the catchments and the length of modelled channel for both watercourses.





Return Period (Years)	Turfford Burn (m^3/s)	Leader Water (m^3/s)
2	5	59
50	13	164
200	18	240

Flood mapping – Leader Water



Property Type	Number at Risk *(1 in 200 year flood)*
Residential	2
Commercial	2

Note that this only includes those properties flooded above floor level. Others may be surrounded with water but not inundated.

How do we create these flood maps?

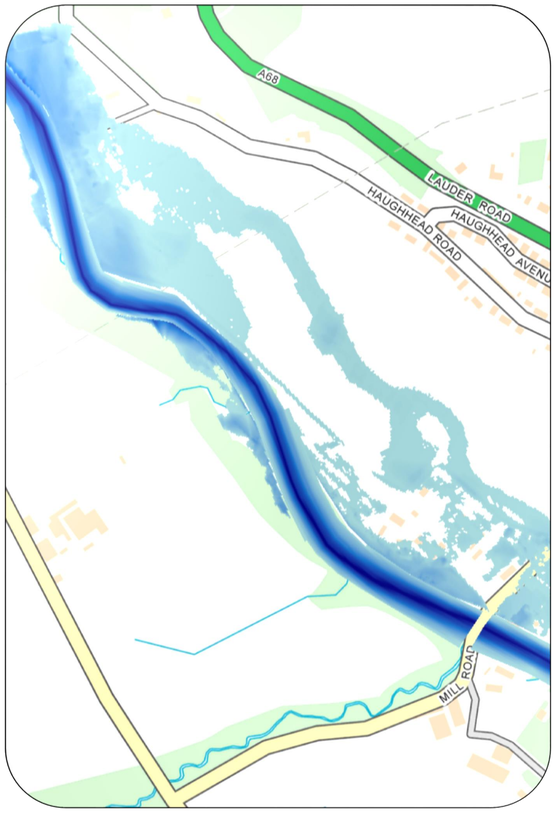
- A physical survey captured the measurements of river channels, banks and structures along each watercourse.
- These measurements were input into a computer model, along with calculated river flows for a range of storm events.
- This model produced a flood level which was then applied to a 3D representation of the land surface and buildings. The outcome resulted in a detailed flood map of river flooding in Earlston

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 Leader Water

Out of bank flow paths, key structures and constraints were identified. Flood flow from the Leader Water is first seen in the agricultural land downstream of Haughhead and then begins to fill the floodplain around Mill Road and around the playing fields near the Turfford Burn confluence. Properties at Haughhead, Mill Road (including Rhymers Mill) and near Acorn Drive are affected. Bridges have limited impact on flood waters.



Floodplain flows

High capacity bridges

Varied land use

Has this flow mechanism been seen before?

Flooding is known to have left the river on the left bank and entered the agricultural land to the north.

The limited reports of the 1948, 1984 and 2012 flood events suggests similar flood mechanisms have been experienced.

The aim of the scheme is to be proactive and mitigate against floods like or in excess of the 1948 flood.

Leader Water 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.

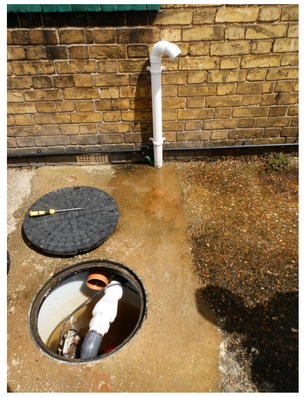
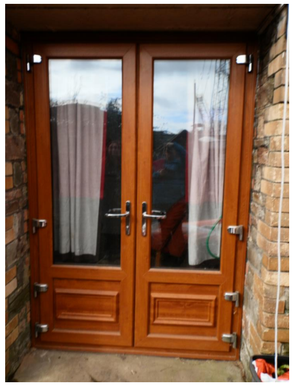
- **Relocation -** Relocation or abandonment of properties not usually socially or politically viable.
- **Flood Warning –** Warning on the Leader Water should be maintained.
- **Resistance Measures –** Property level protection is well suited to the shallow flood depths experienced in some flood events but not all on this large watercourse.
- **Resilience Measures -** Unlikely to be economically viable.
- **Watercourse Maintenance –** Council should continue the scheduled maintenance regime.
- **Natural Flood Management –** Some opportunities identified within the upper catchment.
- **Storage –** Insufficient space away from houses and roads to store sufficient volumes of flood water.
- **Control structures –** The large structures required on the Leader Water are not feasible considering the scale of the flooding problem.
- **Demountable Defences –** A permanent wall or embankment is more suitable than demountable defences.
- **Direct Defences –** A combination of walls or embankments could contain flows on the watercourse.
- **Channel Modification (incl. channel lowering) –** Not capable of delivering long-term benefits.
- **Diversion channel –** No suitable route for the diversion.
- **Structure Modification –** Bridge modification not expected to bring any benefit due to lack of bridge impact.

Most desirable options
Good practice and partial solutions
Least desirable options

Leader Water – Short Listed Options

Option 1:
Property Level Protection (PLP) (Earlston-wide)

- Automatic PLP installed in all 8 properties at flood risk from either watercourse in Earlston to protect against the 100 year flood event (500 year for 7 of these properties). PLP shall involve surveying each property to identify entry points and recommend appropriate PLP, but could include self sealing door and air vents and non return valves on plumbing.
- Estimated cost £0.4m.
- Estimated damage avoided £0.6m.

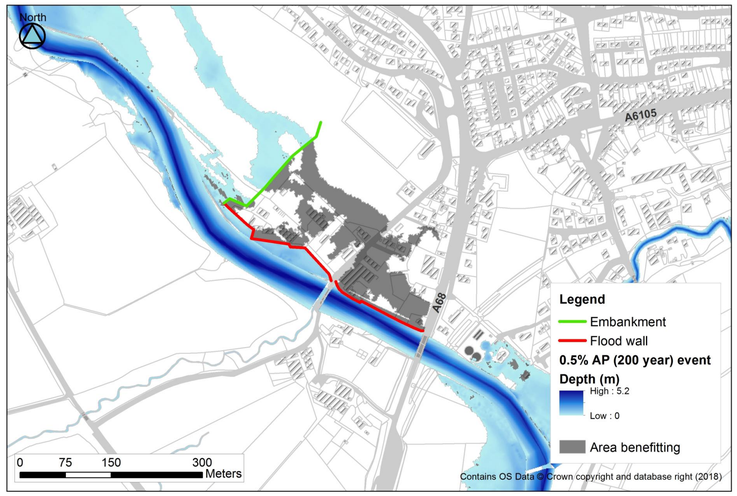




Typical examples of PLP

Option 2:
Direct flood defences (walls and embankments)

- This option provides a 200 year standard of protection to those properties who would flood above floor level for the 200 year event.
- Average wall height 0.85m with freeboard and embankment height 0.7m.
- Total combined defence length 470m.
- Climate change adaptation would require significantly longer walls and raising of road bridge.
- Estimated cost £2.1m.
- Estimated damage avoided £0.4m.

Typical example of a flood wall

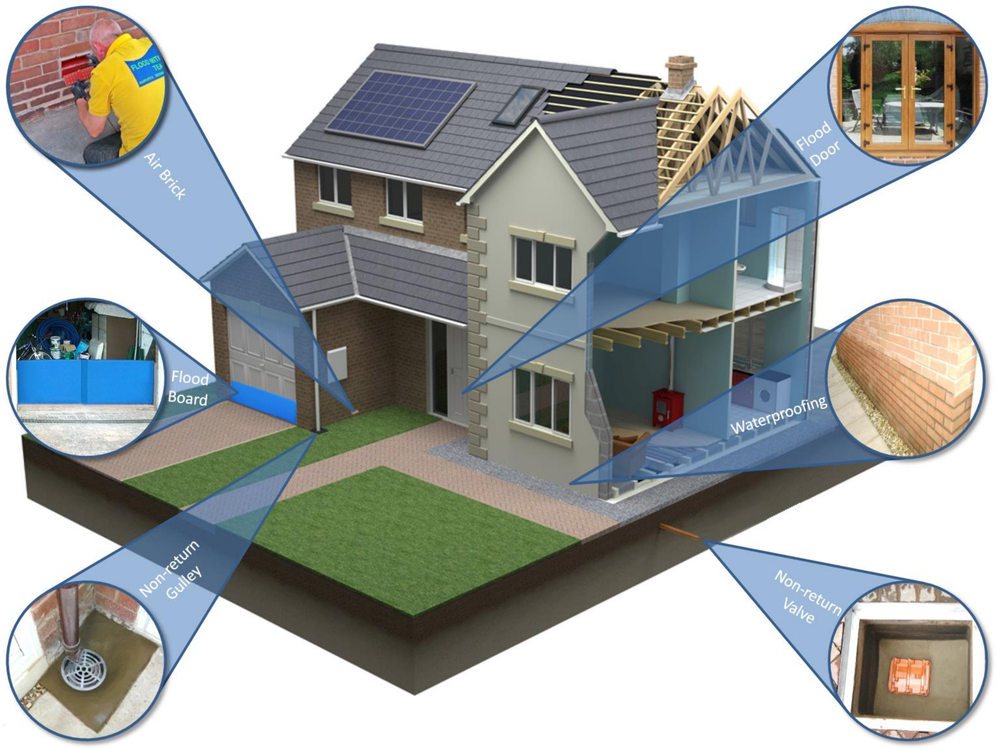


Proposed flood defences

See adjacent technical drawings for further details of this option

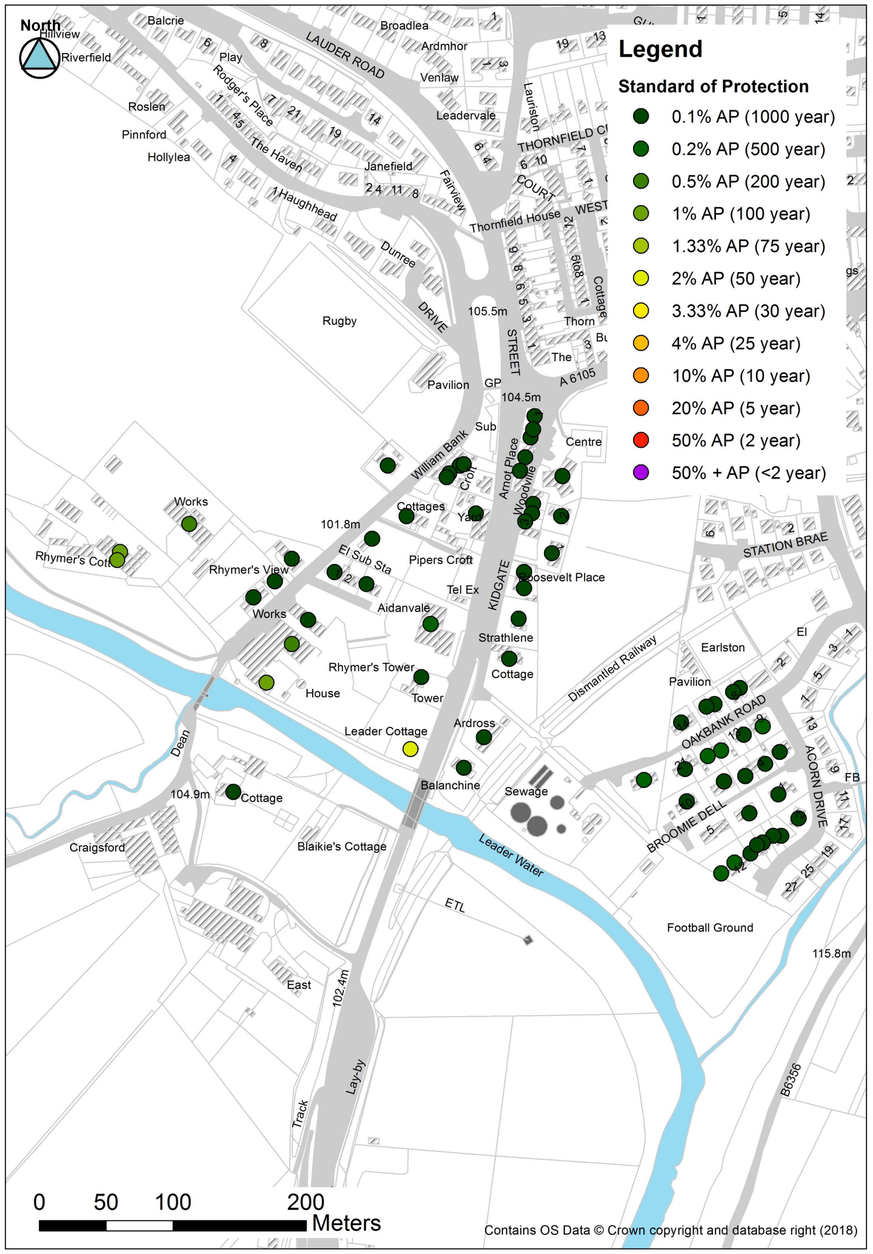
Option 1 - Property Level Protection – Leader Water

PLP is the last form of defence before water gets into the building. Automatic PLP is proposed for each property, four on the Leader Water – two residential and two non-residential. It can protect these properties to the 100 year flood event.
The standard of protection (SOP) map indicates the existing level of protection to each property in the flood study.

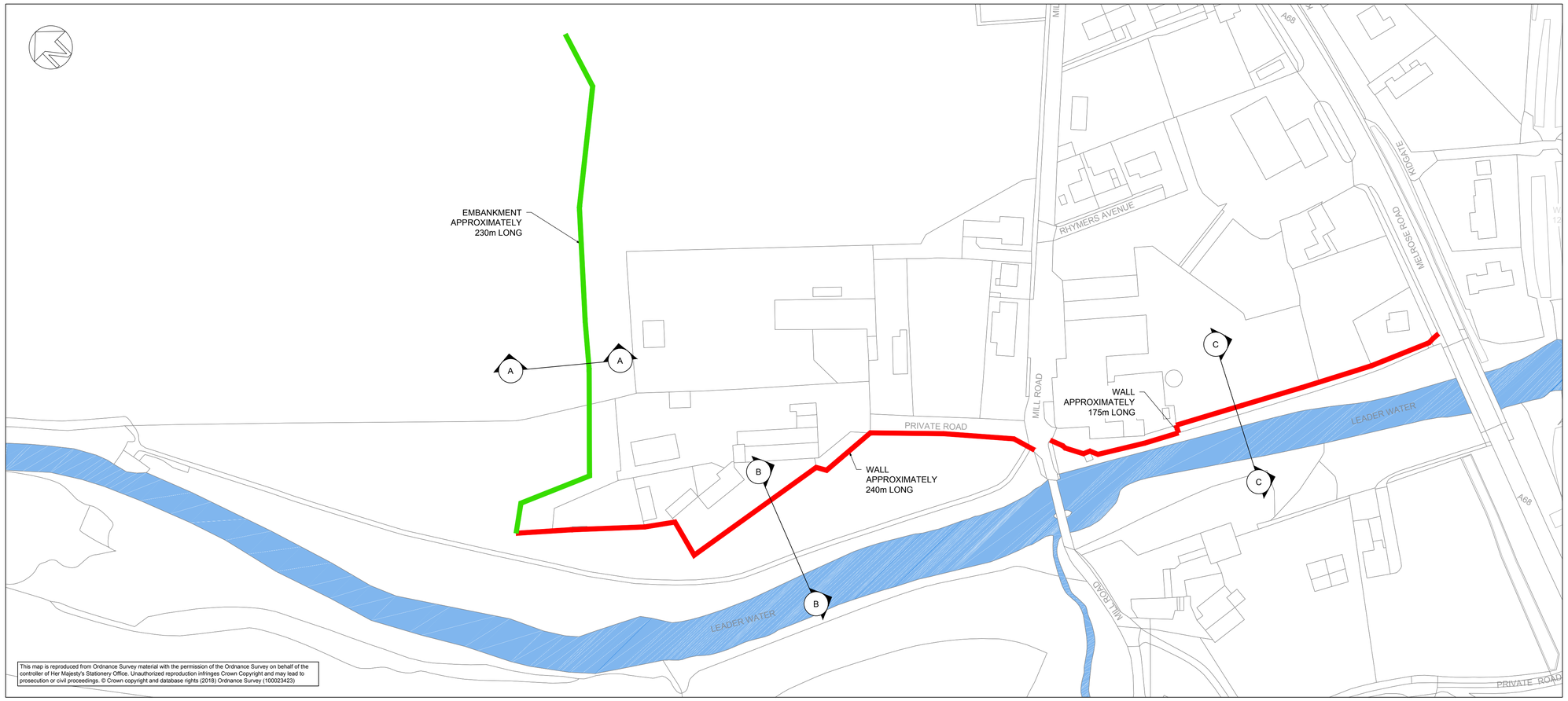


Examples of how Property Level Protection can mitigate the risks of flood inundation (image courtesy of Whitehouse Construction Co. Ltd)

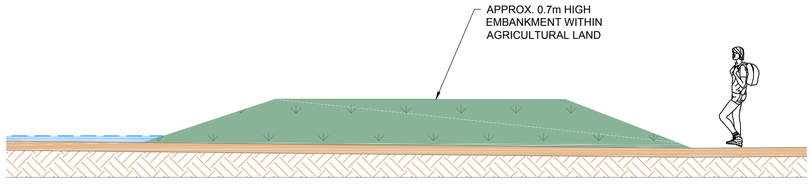
Standard of protection map



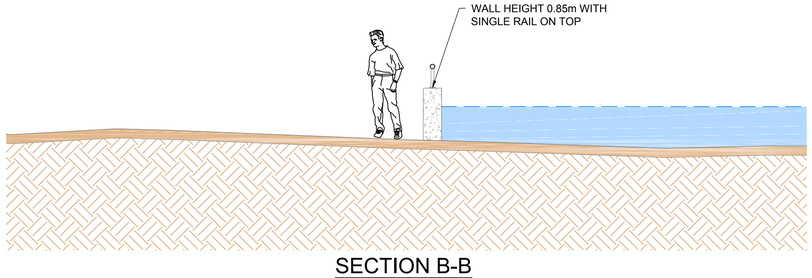
Earlston
Option 1: Leader Water
200 Year Direct Defences



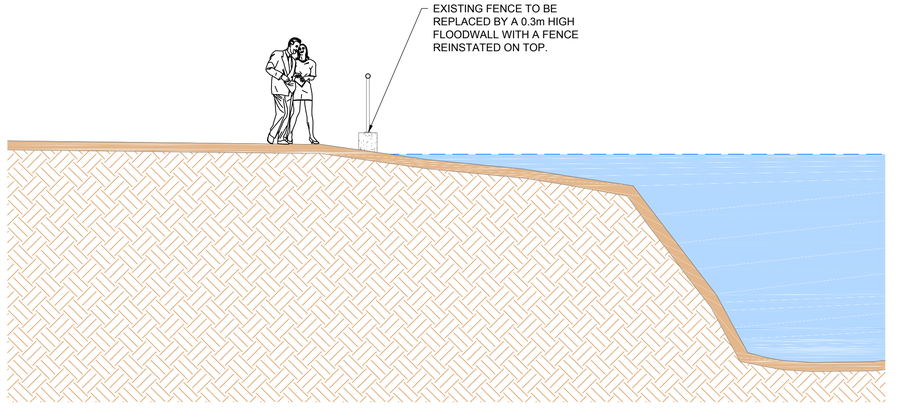
PLAN
1:1000



SECTION A-A
1:50



SECTION B-B
1:50



SECTION C-C
1:50

OPTION SUMMARY.
Construction of direct defences along the channel to the alignments shown. Defences set back from watercourse where possible. Defence heights kept to a minimum and only included around properties shown to flood at the 1 in 200 year flood event.

LEGEND
- 200 YEAR FLOOD LEVEL
- EMBANKMENT DEFENCE
- WALL DEFENCE
- WATERCOURSE

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: Earlston
Leader Water: Option 1
Plan and Cross Sections
for

Client: Mott MacDonald / Scottish Borders Council

Scale: As Shown @ A1

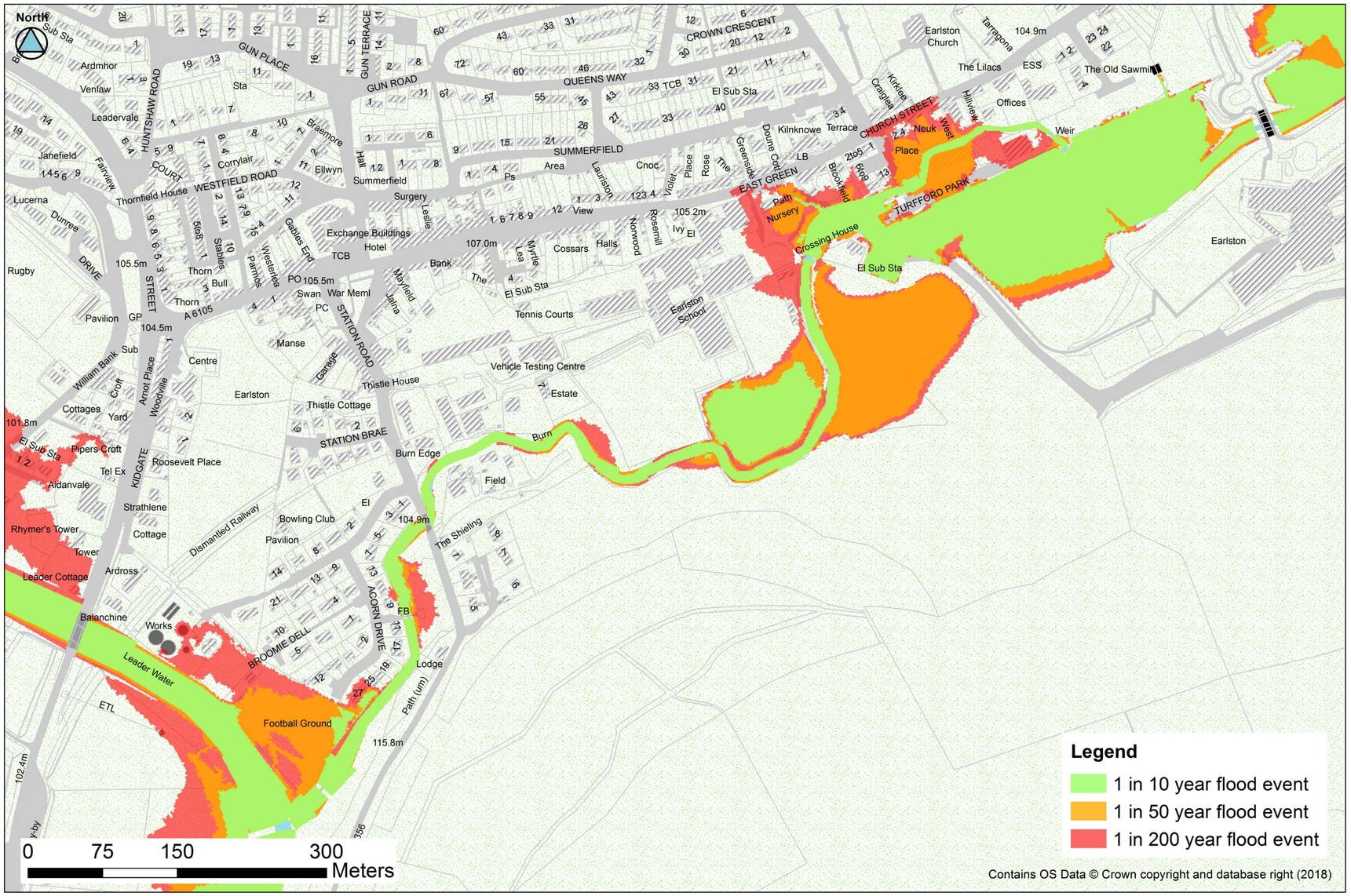
Drawn:	A Coad	13/02/18
Designed:	B Bedford	12/02/18
Checked:	A Pettit	12/07/18
Approved:		

Project Number: 2017s5526

Drawing Number: AEM-JBAU-EA-LW-IM-C-1100

Revision: P03

Flood mapping – Turfford Burn



Property Type	Number at Risk *(1 in 200 year flood)*
Residential	2
Commercial	2

Note that this only includes those properties flooded above floor level. Others may be surrounded with water but not inundated.

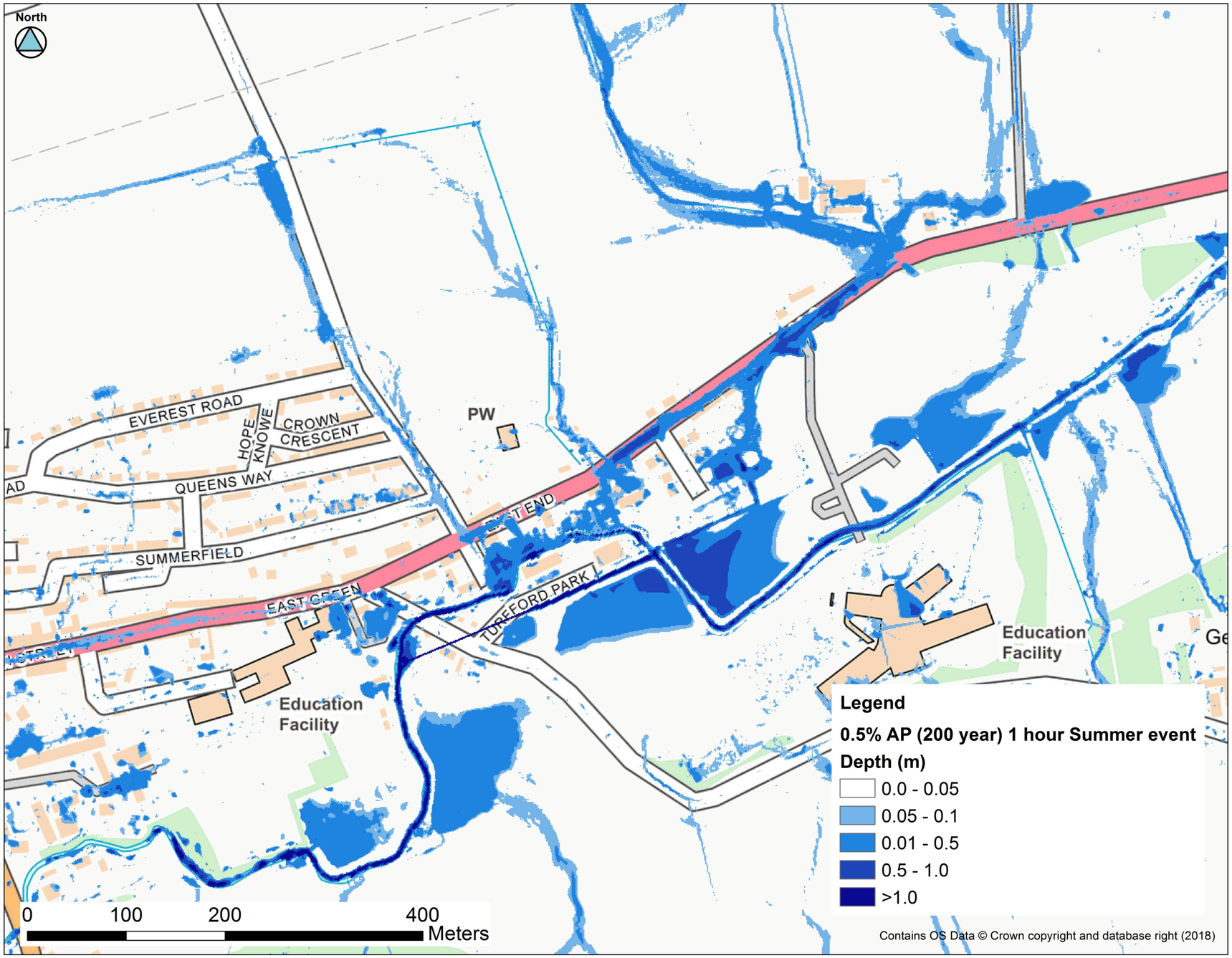
How do we create these flood maps?

- A physical survey captured the measurements of river channels, banks and structures along each watercourse.
- These measurements were input into a computer model, along with calculated river flows for a range of storm events.
- This model produced a flood level which was then applied to a 3D representation of the land surface and buildings. The outcome resulted in a detailed flood map of river flooding in Earlston

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.

Surface water mapping



How do we create these flood maps?

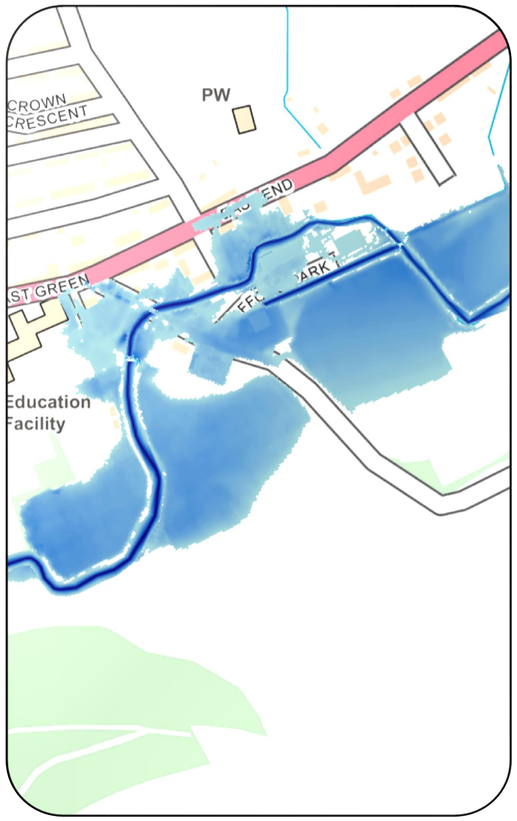
- A computerised version of the ground surface known as a Digital Terrain Model (DTM) is first procured, giving the highs and lows of the ground.
- Different theoretical rainfall events are then established and these events are put into action – the model simulates the rain falling over the DTM and flowing across the computerised ground surface, flowing in channels and ponding in low points.

What do the maps show?

- The mapping indicates the predicted flooding for a given flood magnitude.
- The 1 in 200 year map shows what is expected to be inundated for a flood that is likely to occur once every 200 years (or with a probability of 0.5% in any one year).
- The '1 hour Summer' event is a short duration high intensity event typically of the kind that causes summer flash floods.
- Alternatively, a '10 hour Winter' rainfall event often produces similarly large flood extents. These two types of events tend to cause the worst flooding dependent on the type of catchment.

Flood mechanisms on the Turfford Burn

Out of bank flow paths, key structures and constraints were identified. Flood flows from Turfford Burn emerge from the burn upstream of the FPS channel, flowing across the High School playing fields and even across Georgefield Bridge towards the Primary School. The FPS culvert is expected to surcharge, causing flooding to Turfford Park and the main Turfford Burn channel near Church Court is expected to overtop its banks during large floods. The burn becomes heavily vegetated in the summer months which could increase flooding during summer events.



Complex out of bank flows

FPS channel

Vegetation growth

Improved flood estimation

We are aware that flooding from the Turfford Burn does affect a small number of properties but has an impact relatively frequently and we therefore recommend the following short term options:

- Improve channel conveyance.
- Installation of telemetry to monitor water level other than at the grille.
- Installation of a flow gauge to provide better flow estimates.

Can we remove the sediment?

1) Is gravel causing a flood risk problem?

In the past sediment in some watercourses in the Border towns was intermittently removed. Furthermore, in some locations it is believed that the bed level of rivers is rising as a result of a long term build up of silt and gravel. Whilst sediment does build up locally, these deposits are not new and the formation and erosion of sediment in Earlston is a **natural process** balanced over thousands of years.

2) Why is sediment in rivers important?

River sediments and their movements form **important habitats for plants, fish and animals**. The removal of sediment can lead to a loss of, or damage to these habitats. Sediment removal can disturb the natural equilibrium of a river which can cause **serious problems with river stability**, often leading to erosion downstream.

3) Would removal of sediment reduce the flood risk?

Our assessment has shown that due to the flood mechanisms on the Turfford Burn there would be little benefit in reducing river bed levels through sediment removal. Additionally, during a flood the water will move material downstream and deposit in any lowered sections, filling any dredged areas back to their original level very quickly. **This was observed in the Bowmont Water** in August 2009 when the river level was lowered by 1m; it was refilled during a flood in the September.

The reasons why wide-scale bed modification is not actively undertaken are as follows:

- Any additional conveyance created by a lowered river channel is **very quickly lost**.
- It is **not considered a sustainable option;** expensive **repeat works** are required to maintain bed levels.
- **Additional bank stabilisation** works may also be required. In many locations **unsightly concrete walls** may be needed or **removal of riparian land** (gardens) and extensive rock armour. This is particularly important in Earlston where some banks are already considered to be overly steep.
- Sediment removal carried out in watercourses requires **regulatory legislation** enforced by SEPA and would require sufficient evidence to support any such applications for removal.

4) What else could be done?

We have looked at a number of other options to mitigate the flood risks on both watercourses, including options for natural flood management in the upper catchment that may help to manage the sediment transport into the downstream reaches. Further modelling is required to investigate the benefits of these options.

Turfford 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 –** Warning would be beneficial on the Turfford Burn alongside other options.
- **Resistance Measures –** Property level protection is well suited to the shallow flood depths from the burn.
- **Resilience Measures -** Unlikely to be economically viable.
- **Watercourse Maintenance –** Council should continue the scheduled maintenance regime.
- **Natural Flood Management –** Some options for NFM in the upper catchment that should be progressed.
- **Storage –** Upstream storage likely to be possible but the intervention is likely to be disproportionate to the scale of the problem.
- **Control structures –** Already a control structure on the burn, modification not necessary and additional structure not likely to improve the situation.
- **Demountable Defences –** A permanent wall or embankment is more suitable than demountable defences.
- **Direct Defences –** A combination of walls or embankments could contain flows on the watercourses but the length of defences required would be excessive given the scale of the problem.
- **Channel Modification (incl. channel lowering) –** Not expected to be short or long term benefit to deepening due to flood mechanisms and problems with maintaining an artificially deepened channel.
- **Diversion channel –** Potential to reroute the burn across the land near the new High School.
- **Structure Modification –** Structures on the burn are not the primary cause of flooding.

Most desirable options
Good practice and partial solutions
Least desirable options

Turfford Burn – Short Listed Options

Option 1:
Property Level Protection (PLP) (Earlston-wide)

- Automatic PLP installed in all 8 properties at flood risk from either watercourse in Earlston to protect against the 100 year flood event (500 year for 7 of these properties). PLP shall involve surveying each property to identify entry points and recommend appropriate PLP, but could include self sealing door and air vents and non return valves on plumbing.
- Estimated cost £0.4m.
- Estimated damage avoided £0.6m.

Typical examples of PLP

Option 2:
Shallow flood diversion channel through playing fields

- 200 year standard of protection.
- Lowering of the left bank of the burn upstream of the FPS channel – old channel and FPS channel maintained.
- Construction of a wide, shallow bypass channel through the High School playing fields.
- Lowering of the road to allow flood waters to pass into agricultural land beyond.
- Estimated cost £1.1m.
- Estimated damage avoided £0.7m.

Typical flooding of shallow bypass channel

Option 3:
Complete bypass of the burn

- 200 year standard of protection.
- Burn completely redirected to the east of playing fields – old channel abandoned apart from drainage.
- Culvert to carry bypassed channel under the road leading to Georgefield.
- Estimated cost £3.1m.
- Estimated damage avoided £0.7m.

See adjacent technical drawings for further details

Typical example of meandering bypass channel

Turfford Burn & Brock Burn – Short Listed Options

Option 4:
Upper catchment storage

- 200 year standard of protection but storage area would pass forward the 50 year flow meaning that 2 properties would require PLP to reduce residual risk.
- Embankment construction upstream of new High School to a height of 4.7m.
- Estimated cost £4.9m.
- Estimated damage avoided £0.5m.

Typical flood storage area

Brock Burn:
Diversion channel

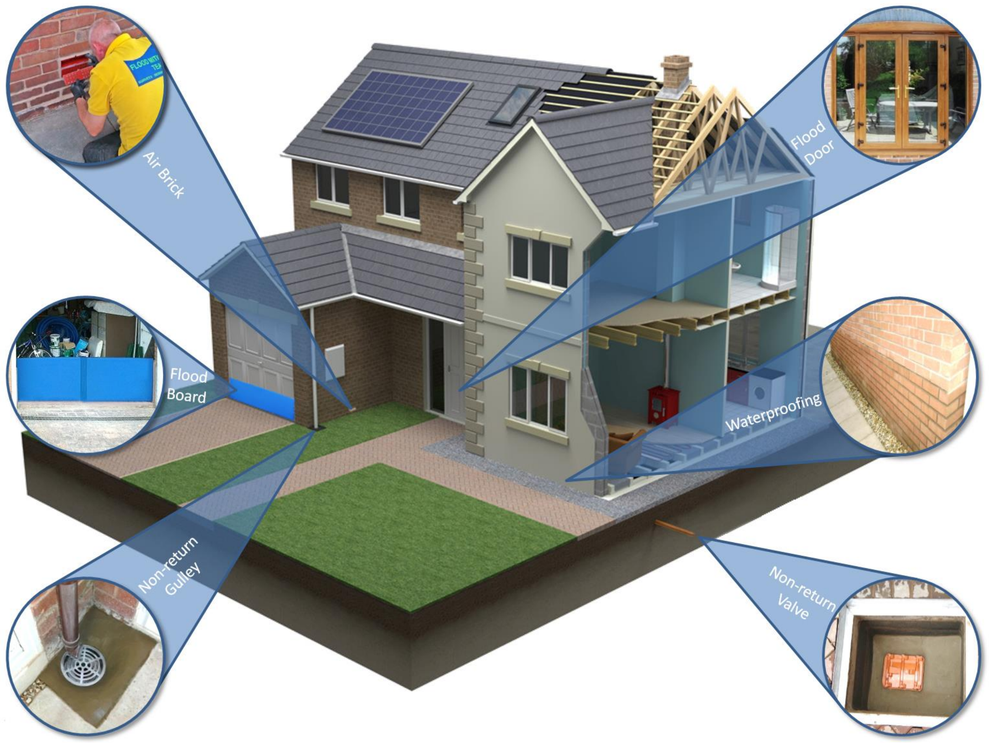
- 200 year standard of protection.
- Small channel built along contours to carry the unnamed burn and Brock Burn under the A6105 and into the Turfford Burn.
- Not economically appraised.

Typical example of diversion channel

See adjacent technical drawings for further details

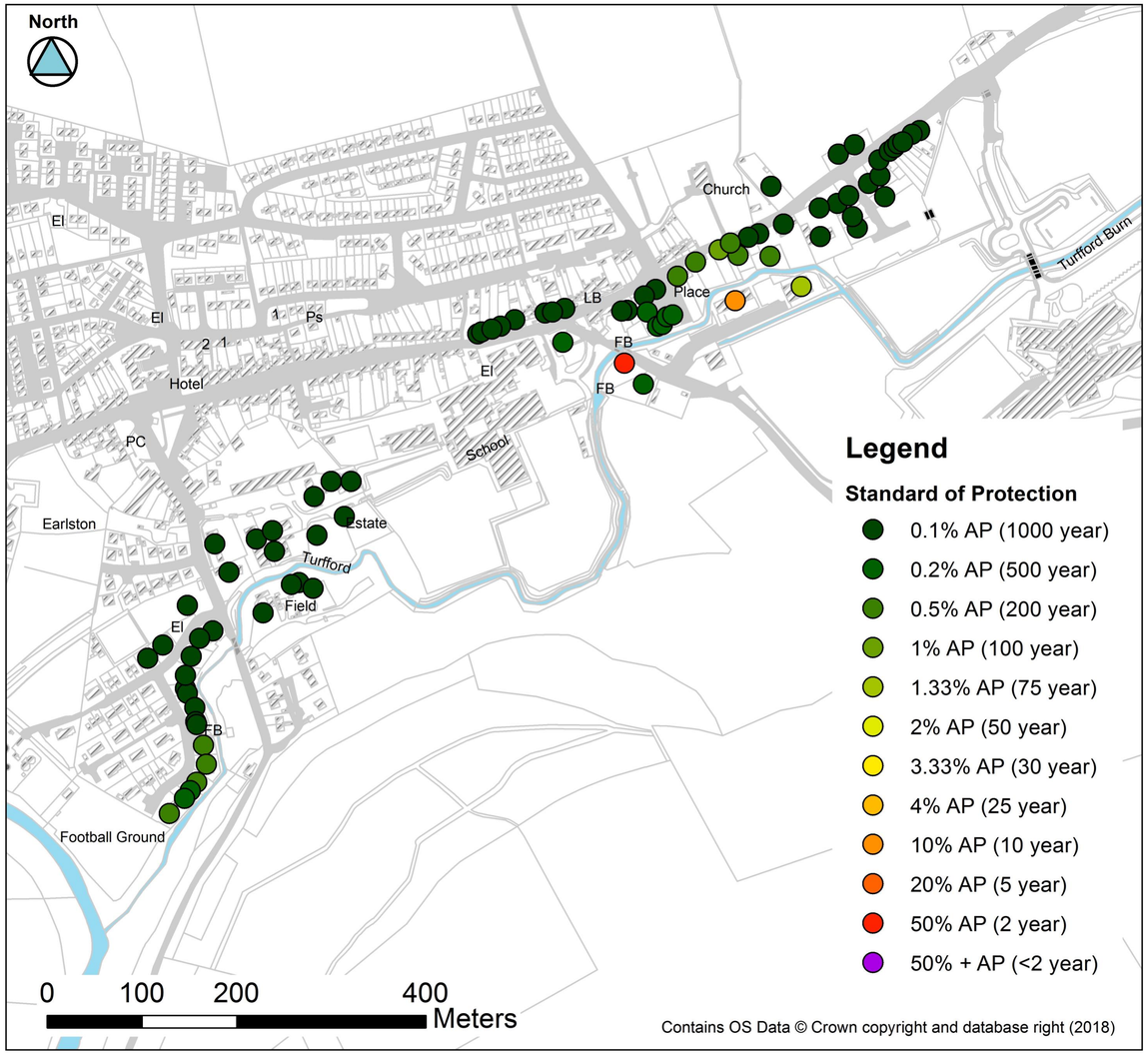
Option 1 - Property Level Protection – Turfford Burn

PLP is the last form of defence before water gets into a building. Automatic PLP is proposed for each property, four on the Turfford Burn – two residential and two non-residential. It can protect these properties to the 500 year flood event. The standard of protection (SOP) map indicates the existing level of protection to each property.

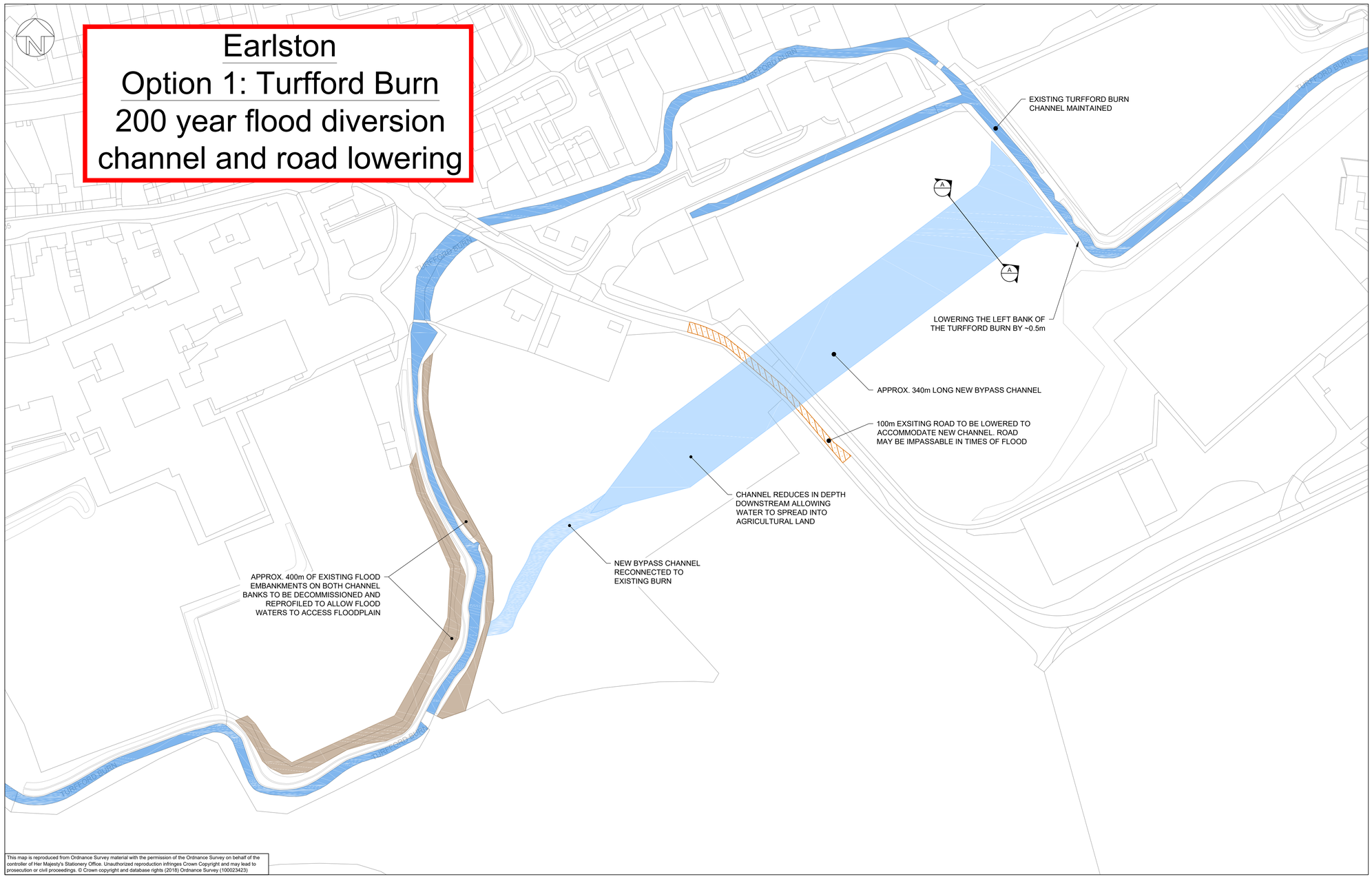


Examples of how Property Level Protection can mitigate the risks of flood inundation (image courtesy of Whitehouse Construction Co. Ltd)

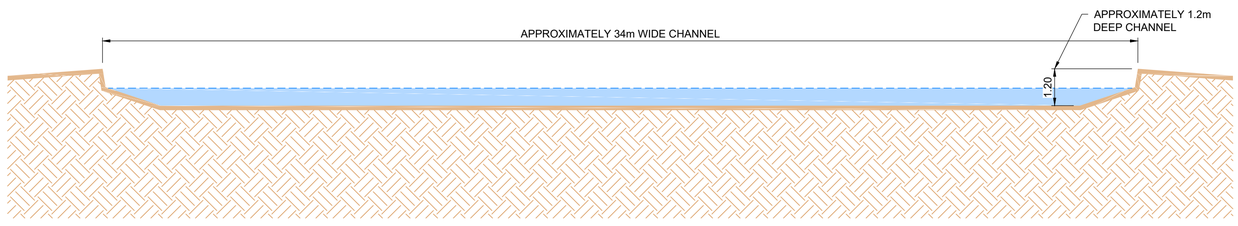
Standard of protection map



Earlston
Option 1: Turfford Burn
200 year flood diversion channel and road lowering



PLAN
1:1000



SECTION A-A
1:100

OPTION SUMMARY. This option aims to provide a high standard of protection through the installation of an approximately 340m long flood relief channel to allow a portion of the burns' flows to bypass the main channel and the FPS channel. The work includes the following:
1. Excavate a 340m long channel to a maximum depth of 1.2m, bottom width of 30m, side slope of 1 in 3, channel slope of 1:435 and a Manning's n roughness value of 0.035.
2. Lower the left bank of the Turfford Burn at the entrance to the bypass channel to a level of approximately 103.5m, a reduction of 0.5m.

LEGEND
- 200 YEAR FLOOD LEVEL
- EXISTING WATERCOURSE
- DIVERSION WATERCOURSE
- DECOMMISSIONED FLOOD EMBANKMENTS
- NEW ROAD CONSTRUCTION

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: Earlston
Turfford Burn: Option 1
200 Year Partial Bypass Channel
for

Client: MOTT MACDONALD; Scottish Borders Council

Scale: As Shown @ A1

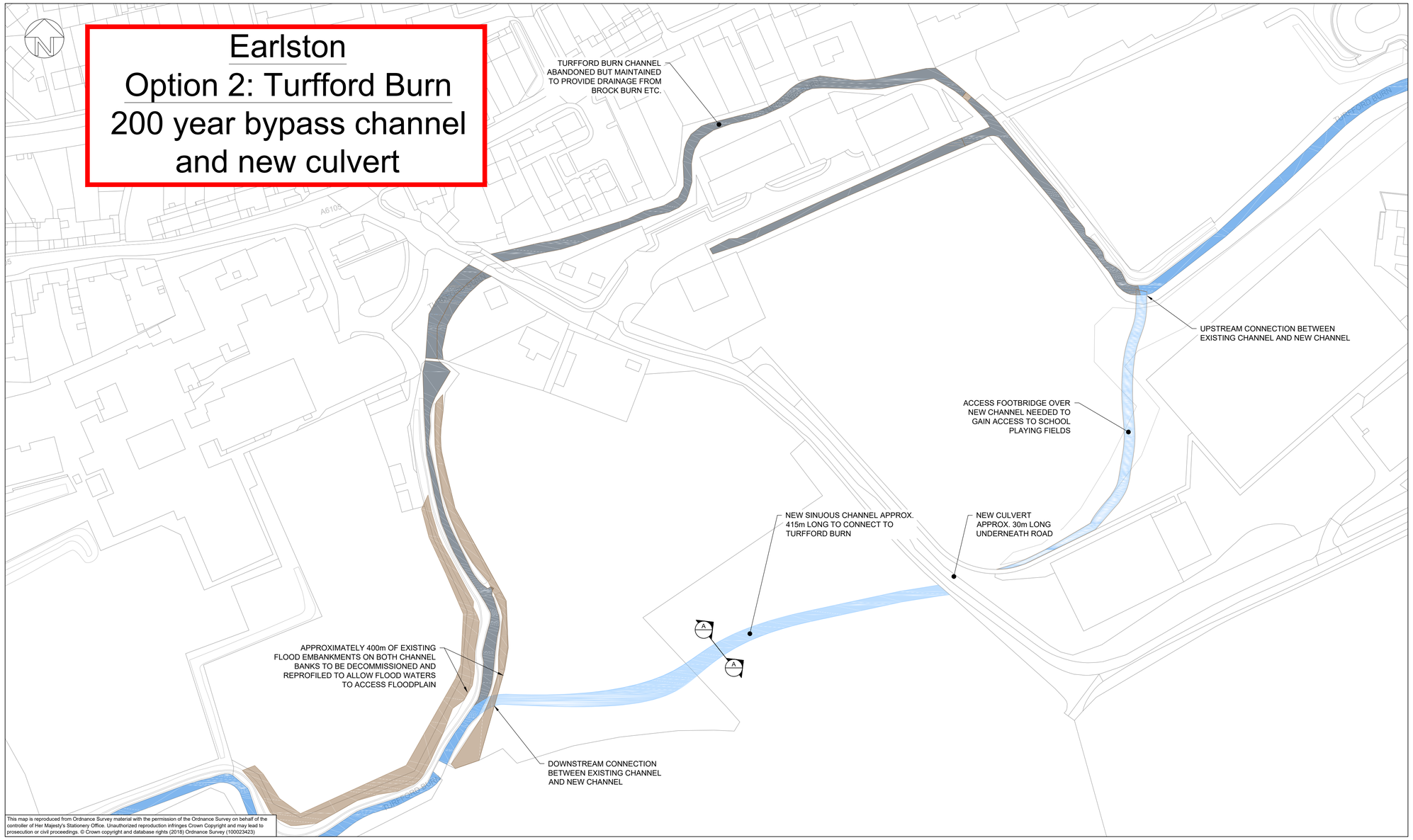
Drawn:	A Coad	13/02/18
Designed:	B Bedford	12/02/18
Checked:	A Pettit	12/07/18
Approved:		

Project Number: 2017s5526

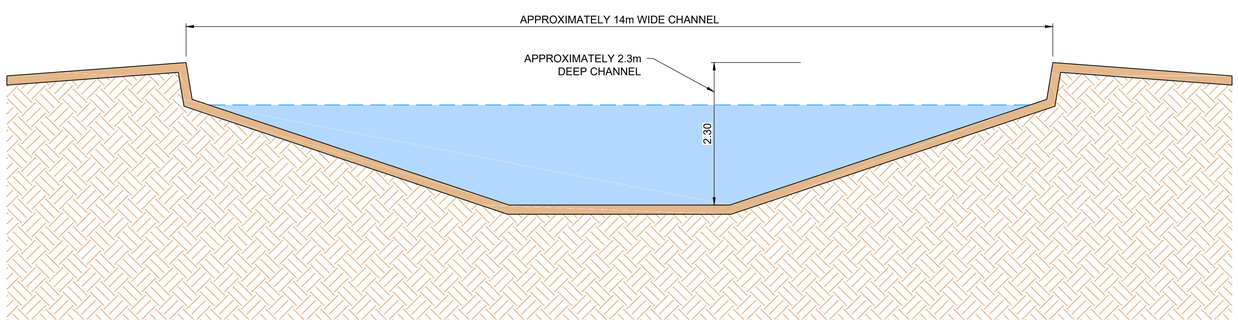
Drawing Number: AEM-JBAU-EA-TB-IM-C-1100

Revision: P01

Earlston
Option 2: Turfford Burn
200 year bypass channel and new culvert



PLAN
1:1000



SECTION A-A
1:200

OPTOIN SUMMARY. This option aims to provide a high standard of protection through the installation of an approximately 415m long replacement channel positioned around the High School athletics pitch to allow all of the burns' flow to bypass the main channel and the current FPS channel. The work includes the following:
1. Excavate a 415m long channel to a maximum depth of 2.3m, bottom width of 3m, side slope of 1 in 3, channel slope of 1:200 and a Manning's n roughness value of 0.035.
2. Lower the left bank of the Turfford Burn at the entrance to the new channel by approximately 1.8m.
3. Block the current Turfford Burn and FPS channels at the entrance to the new channel.

LEGEND
- 200 YEAR FLOOD LEVEL
- EXISTING WATERCOURSE
- DIVERSION WATERCOURSE
- ABANDONED CHANNEL

	Comments
Rev.:	Date / Drawn / Designed / Checked / Approved

Client Approval
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- 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: Earlston
Turfford Burn: Option 2
200 Year Total Bypass Channel
for

Client: MOTT MACDONALD / Scottish Borders Council

Scale: As Shown @ A1

Drawn:	A Coad	13/02/18
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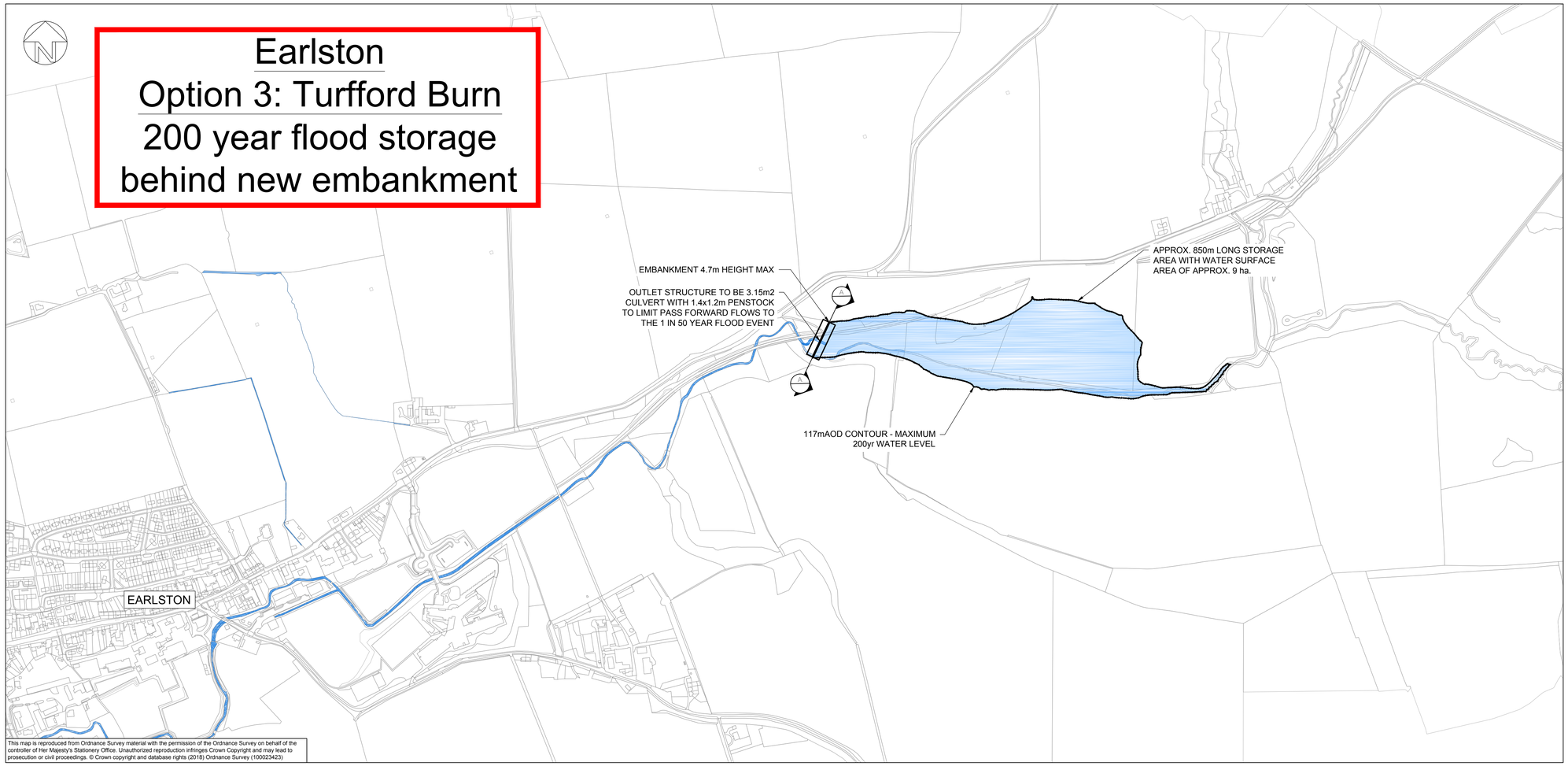
Checked:	A Pettit	12/07/18
Approved:		

Project Number: 2017s5526

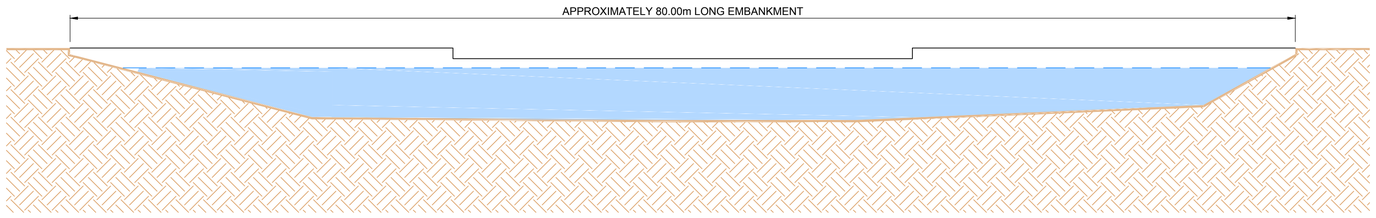
Drawing Number: AEM-JBAU-EA-TB-IM-C-1200

Revision: P02

Earlston
Option 3: Turfford Burn
200 year flood storage behind new embankment



PLAN
1:5000



SECTION A-A
1:200

OPTION SUMMARY. This option aims to provide flood attenuation in the upper catchment through construction of embankments approximately 1km upstream of Earlston High School on the Turfford Burn. The work includes the following:
1. Construction of an embankment on the Turfford Burn to retain the majority of floodwater in the upper catchment
2. Construction of an orifice control unit to release stored water into the burn downstream at a rate which avoids flooding within Earlston.
Note: This option allows the 1 in 50 year flood to pass through the embankment which would ordinarily cause two properties to flood, the Crossing House and the industrial units on Turfford Park industrial estate. These properties would require Property Level Protection (PLP) to be protected up to the 1 in 50 year flood event. With PLP in place they would be protected up to the 200 year flood event thanks to the protection offered by the storage embankment. The other two properties at risk on the Turfford Burn would be protected up to the 200 year flood event without the use of PLP.

LEGEND

- 200 YEAR FLOOD LEVEL
- EXISTING WATERCOURSE
- STORAGE AREA

	Comments
Rev.:	Date / Drawn / Designed / Checked / Approved
Client Approval	
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	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: Earlston
Turfford Burn: Option 3
Flood Attenuation Option
for

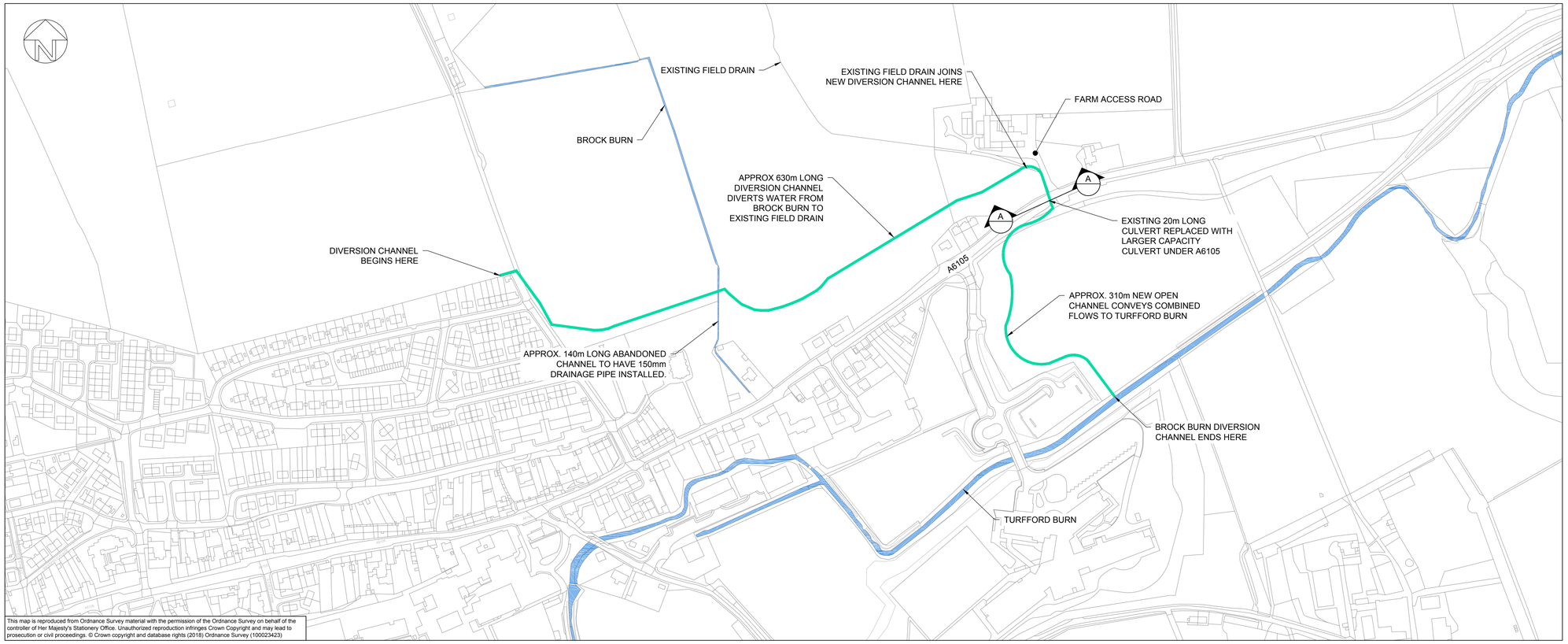
Client: MOTT MACDONALD / Scottish Borders Council

Scale: As Shown @ A1	Drawn: A Coad	13/02/18
	Designed: B Bedford	12/02/18
	Checked: A Pettit	17/07/18
	Approved:	

Project Number: 2017s5526

Drawing Number: AEM-JBAU-EA-TB-IM-C-1300

Revision: P03



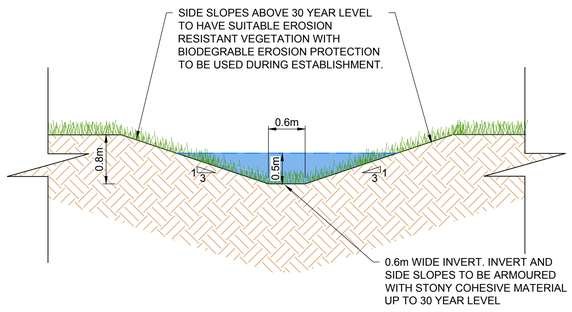
PLAN
1:2500

OPTION SUMMARY. Mitigation option to relieve nuisance road flooding from the Brock Burn.

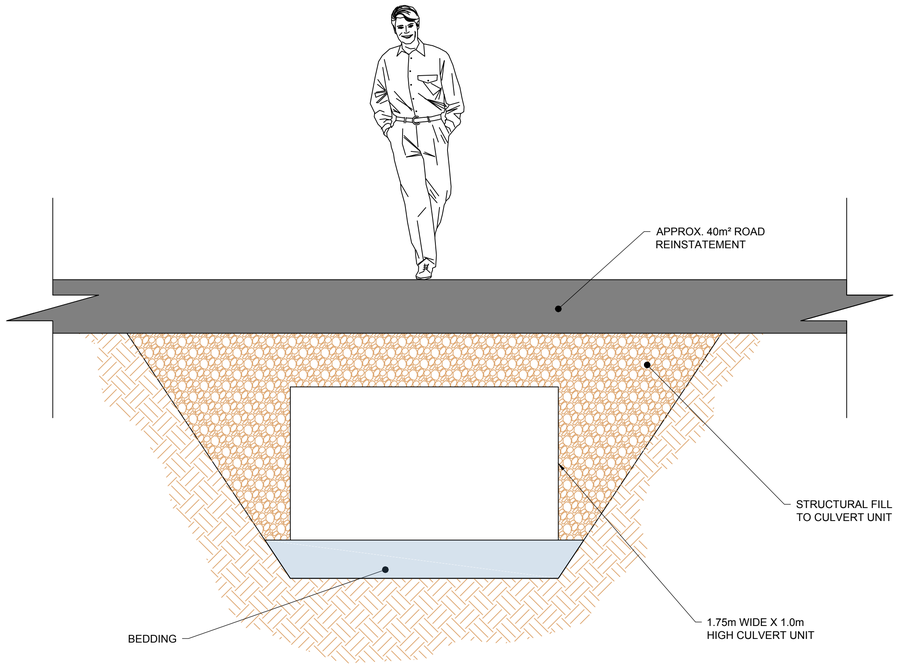
LEGEND

- FINISHED GROUND LEVEL
- 200 YEAR FLOOD LEVEL
- EXISTING WATERCOURSE
- NEW DIVERSION CHANNEL

Earlston
Brock Burn
Channel Diversion Protecting to 200 Year Rainfall Event



INDICATIVE DIVERSION CHANNEL SECTION
1:50



SECTION A-A: A6105 ROAD CROSSING
1:20

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: Earlston
Surface Water Risks: Brock Burn Channel Diversion to 200 year Standard of Protection
for

Client: MOTT MACDONALD; Scottish Borders Council

Scale: As Shown @ A1

Drawn:	A Coad	13/02/18
Designed:	B Bedford	12/02/18
Checked:	A Pettit	17/07/18
Approved:		

Project Number: 2017s5526

Drawing Number: AEM-JBAU-EA-BB-IM-C-1100

Revision: P03

Preferred Option for Earlston

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
Leader Water - Direct Defences (0.5% AP - 200 year)	4	Some implications for RBMP due to walls on riverside. Minimal in-channel working required so little impact on watercourse.	NFM measures have been identified and can be incorporated within the scheme to provide additional benefits. Although the benefits are subject to a more detailed investigation there could be substantial flood risk benefits, particularly during small magnitude floods. NFM may counteract the impacts of climate change to some extent.	Long defences to protect relatively few properties. No protection from Turfford Burn.	Increased defence extents and heights possible. Residual risk to properties at risk from the Turfford Burn properties so would need to be reduced through one of the other options. Possible to use NFM to manage residual risk.	Options should be presented to public for comment. Signage relating to flooding and sand bag stores should be setup. Council should continue to work with Earlston residents alongside 'Resilient communities' programme.	Benefit-cost ratio = 0.2.
Turfford Burn – Flood diversion channel (0.5% AP - 200 year)	4	Bypass would only be used in times of flood so would not impact RMBP significantly. Minimal in-channel works but some bank reinforcement likely to be required.		May mean that playing field can no longer be used. No protection from Leader Water.	The Leader Water direct defences option or PLP could be used to reduce this residual risk. Possible to use NFM to manage residual risk.	Flood Warning should be implemented on the Turfford Burn. Signage and stage board should be installed near Georgefield Bridge in the short term,	Benefit-cost ratio = 0.6.
Turfford Burn - Total bypass channel (0.5% AP - 200 year)	4	Potential for long-term RBMP improvements by replacing the heavily engineered sections of the Turfford Burn with a channel designed to mimic a natural channel.		Loss of main channel may be important to residents. No protection from Leader Water.			Benefit-cost ratio = 0.4.
Turfford Burn - Flood storage (20% AP - 50 year to 0.5% AP - 200 year)	2 (2 properties will continue to flood below the 50 year event)	Occasional storage of water may impact plant life and have negative impact on sediment/nutrient transport in the watercourse.		Temporary storage of flood waters upstream of the town introduces a new risk to the town. No protection from Leader Water.	Larger embankment to store floodwaters possible, this could either reduce the pass-forward flow from the storage area to below the 20% AP (50 year) event or increase the peak protection to the 0.5% AP (200 year) plus climate change.		Benefit-cost ratio = 0.1.
Both main watercourses - PLP (1% AP – 100 year)	8: Only 1 property with 1% AP (100 year) standard of protection; remaining 7 are protected to 0.2% AP (500 year) flood event	Little to no impact.		Flood waters will continue to flood roads, limiting access.	Property survey for the one property at risk from the 0.5% AP (200 year) event with PLP may reveal alternative options; otherwise very little residual risk.		Benefit cost ratio = 1.3 The only cost-effective solution identified for Earlston.
Brock Burn – Diversion channel (0.5% AP – 200 year)	*Damage calculations not performed.*	Channel likely to be more natural than current straight channels so should improve RMBP qualities.		Works may reduce ease of site development as planned in Local Development Plan.	Works do not address flooding from other sources or general ponding on the road during heavy rainfall.	Stage board could be installed on the A6105 in the short term alongside signage.	Not appraised.

Negative			Neutral			Positive

Preferred Options and recommendations

If taken forward and selected by SEPA's Prioritisation process then the preferred option for Earlston is the PLP option. This could be implemented alongside natural flood management.

The PLP option could be progressed sooner and outwith the formal Flood Protection Scheme process, in collaboration between SBC and homeowners.

The short term recommendations are:

- Installation of a gauge on the Turfford Burn to allow flood warnings to be issued.
- Vegetation management on the Turfford Burn.
- Awareness raising for sandbag stores and flooding in general.

What can we do in terms of natural flood management?

What is natural flood management?

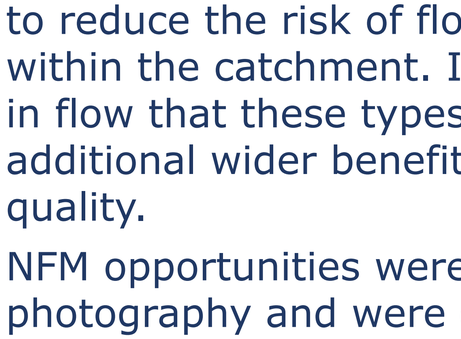
Natural flood management (NFM) is when natural processes are used to reduce the risk of flooding by slowing flows and storing water within the catchment. It is however difficult to quantify the reduction in flow that these types of measures can deliver. NFM also offers additional wider benefits by restoring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

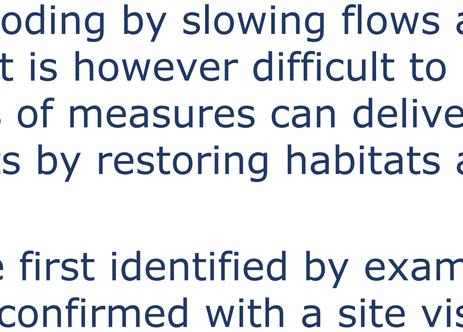
The NFM measures which have been proposed for the Earlston catchments include:

- Improved land management practices
- Working within the banks (buffer strips, debris dams)
- Woodland planting
- Wetland creation and leaky barriers

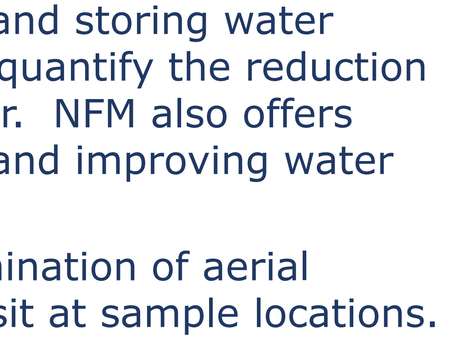
The Council will need to investigate the potential benefits before working with other parties on developing these options further.



Typical example of wetland creation

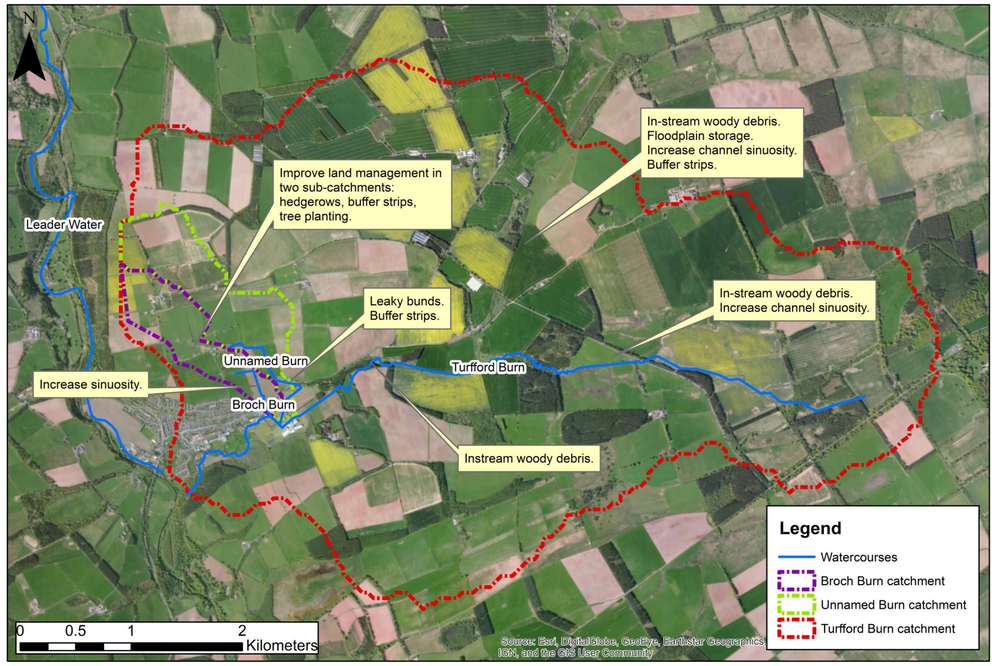


Typical example of in-channel debris barrier



Typical example of young woodland

Location and type of measures suggested for the Turfford Burn catchment



An assessment was also carried out for the Leader Water 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 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