

National Trust Purbeck: Swan Brook NFM Opportunities



Feasibility Assessments

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May 2024

1. Introduction

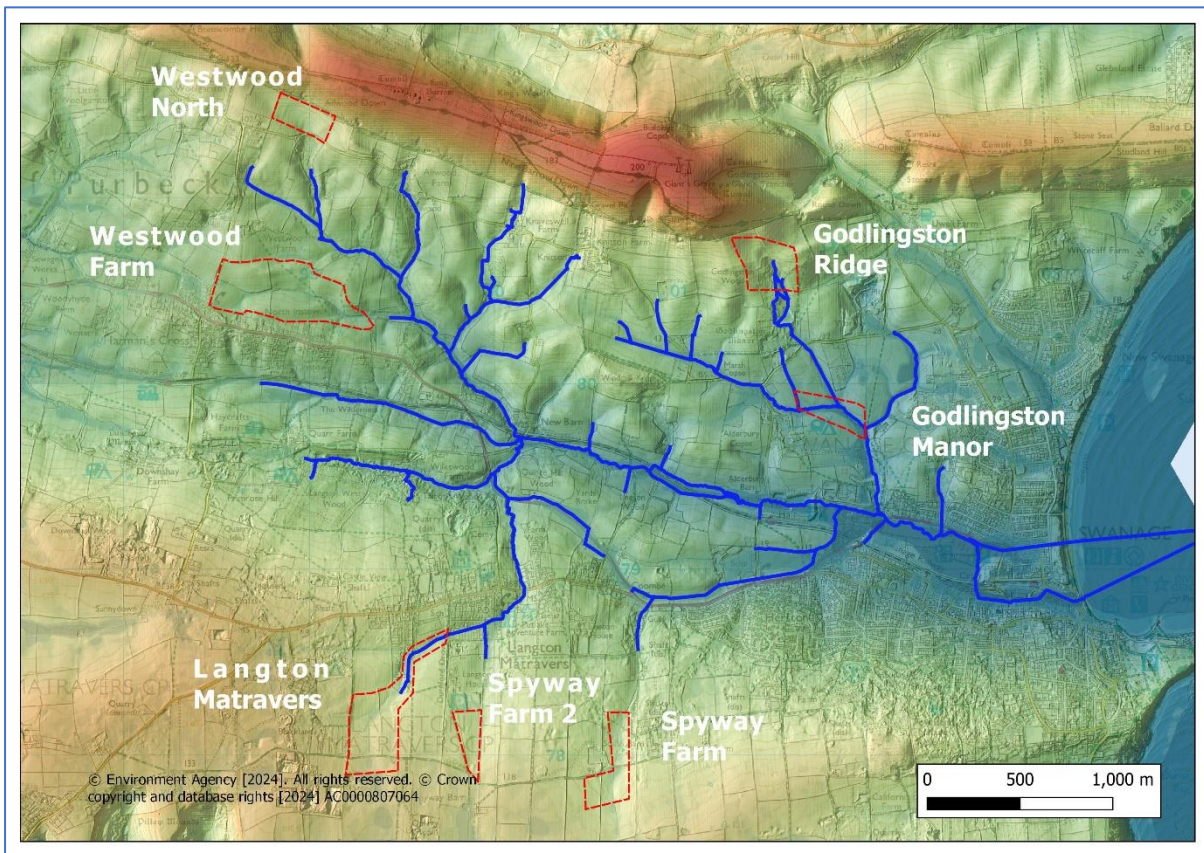
The National Trust are managing an area of approximately 3600 hectares of land at Purbeck. The land is generally farmed but is also being managed for conservation including in this case improvements to surface water hydrology. Within the holding is the Swan Brook catchment which drains to Swanage.

A Natural Flood Risk Management approach is being implemented in the Swan Brook catchment to complement existing management approaches. Funding has been secured to implement measures at 7 sites which are in the holding of the National Trust.

An investigation is reported below to document surface flow pathways on the selected sites and to identify if there are potential measures to work with natural processes to reduce flood risk through catchment interventions. The investigation to identify potential measures has:

- Undertaken desk-based site characterisation from mapping and interrogated the Environment Agency LiDAR (DTM) data for an understanding of localised topography;
- Completed a site visit to develop site specific detail, identifying site-specific processes and defining measures to work with natural processes to reduce flood risk;
- Developed an inventory of potential measures.

Seven locations are considered in the following report.



N.B. Detailed locations are provided within the report using the What3words referencing system

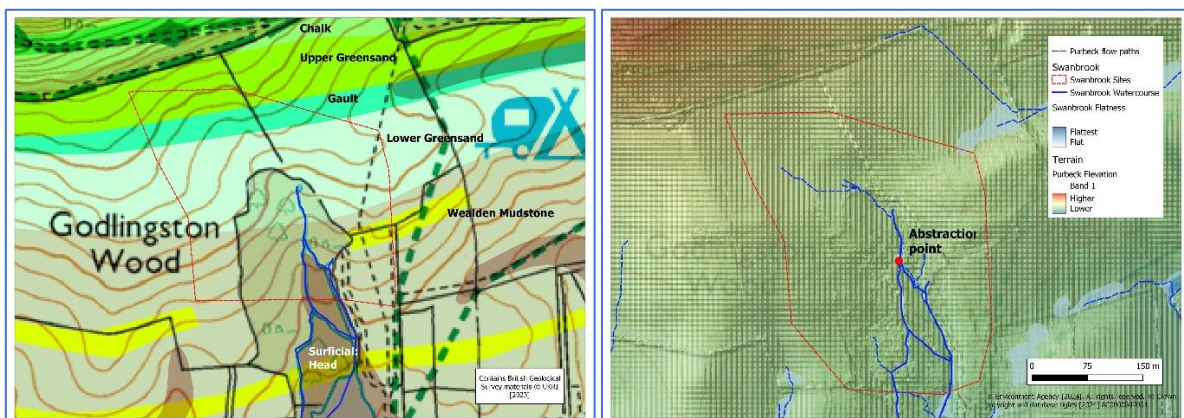
4. Godlingston Ridge

Surface Water Drainage and Topography

Flow at Godlingston Ridge is derived from emerging springs from permeable Chalk and Sandstone bedrock meeting less permeable mudstone and surficial Head deposits. Springs emerging in pasture land above the main area of woodland are currently heavily poached by livestock and then managed through a drainage channel into an area of woods. Within the woods more springs emerge to form the headwaters of two tributary streams.

An abstraction of spring flow removes water for bottling and is located at the head of the eastern tributary.

The abstraction does not appear to influence the pathway of the two tributary channels which appear to follow the boundary of the surficial geology at the site. The influence of geology appears to shape valley form creating narrow and steep side ravine forms with a limited width of adjacent riparian “floodplain” area.



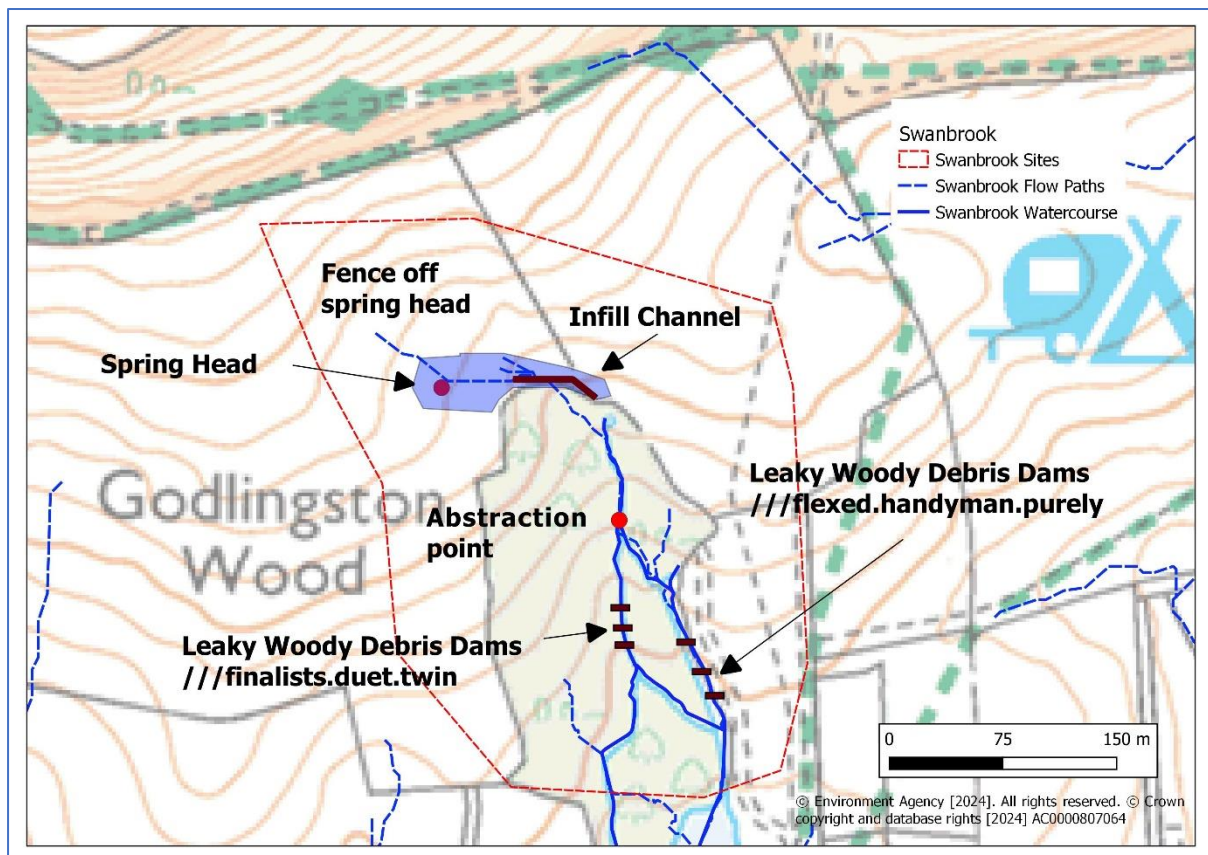
Approach to working with natural processes.

Surface flow originates in the catchment area from a groundwater/spring supported flow pathway combined with rainfall runoff. It is unlikely that any changes can be made to reduce the generation of a surface water flow but the pathway of flow is modified above the wooded area to accelerate drainage from the livestock poached/pasture area.

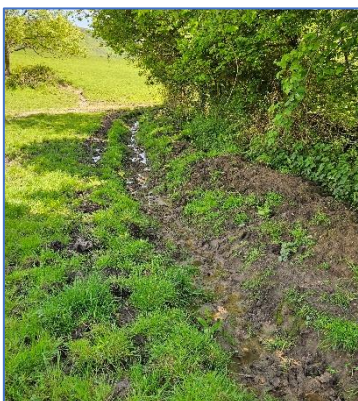
The abstraction for bottled water may have some impact on the volume of water in the stream at base flow but is not anticipated that it will impact of rainfall-runoff spate type flows with which NFM is concerned. Similarly, it does not appear that the stream has been significantly modified in its pathway due to the abstraction.

Geological boundary appears to influence flow pathway more than modification. The narrow ravine-type valley form means tree fall can span the channel limiting the interaction of woody debris with the flow pathway.

Measures to slow flow delivery rather than reduce source are proposed. A summary of proposed measures is shown below.



Natural Flood Management Opportunity – Runoff Management



The spring head above the wooded area should be protected from poaching by livestock through fencing off the area which is naturally wet, to prevent access. Poaching influences both flow pathway but more importantly, is a source of fine sediment to the tributary stream.

A channel which has been created to concentrate the spring flow should also be infilled and flow allowed to spread as a diffuse flow in the protected area.

Natural Flood Management Opportunity – In channel slow flow

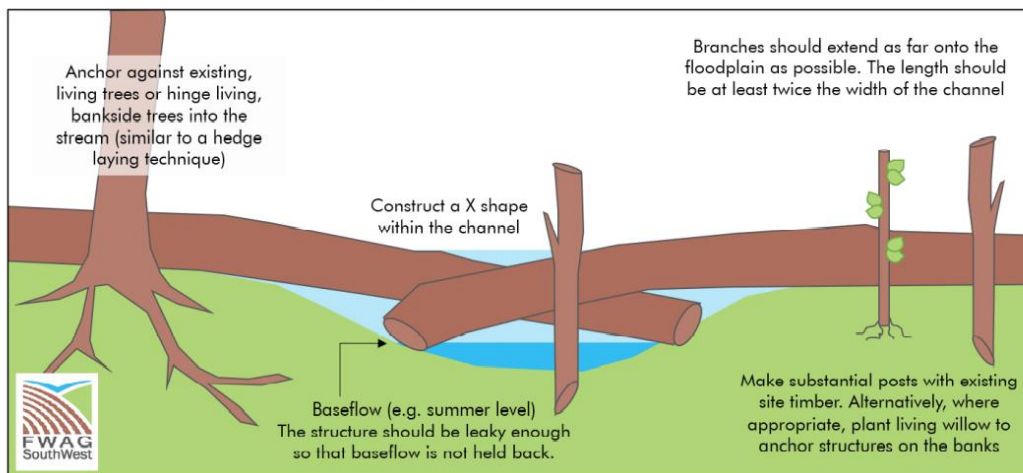
There is potential to slow the delivery of flow within the tributary channel by increasing the frequency of wood within the channel. Reaches for addition of wood should be considered where there is an availability of riparian “floodplain” for water to create overbank flow and occupy a wider cross section. Where the channel is confined, current accumulation of natural wood in the channel has caused a downward erosion into the bed of the stream so it is advised to avoid areas with no adjacent flatter land.

Two tributary reach locations are proposed, with addition of up to 5 dams per location.



A basic design of woody debris in the channel is shown below.

Structure configuration and Securing options



The leaky woody debris dams will be installed manually. Works will be undertaken using a chainsaw and debris manually manoeuvred into place. Any fixings will be manually installed.

The approach to installation will be:

- Fell and lever the entire tree partially or entirely into the watercourse from the riverbank, with the branches facing either upstream or downstream;
- Fell with :
 - no hinge so that the tree is detached from the stump (requires staking of the trunk or securing to other trees on bank); or
 - (if possible) a hinge to enable the tree to carry on living, and to naturally secure it to the bank;
- Secure the head of the tree (main branches) and the trunk, with stakes made from local durable wood;
- Stakes securing the tree should be on the downstream side, angled so the top of the stake is pointing upstream and $>0.1\text{m}$ above the top of the felled tree;

Where stakes are used to secure the tree to the river bank and retain in-channel, the woody debris will be attached to the stake to minimise the risk that the tree floats away.

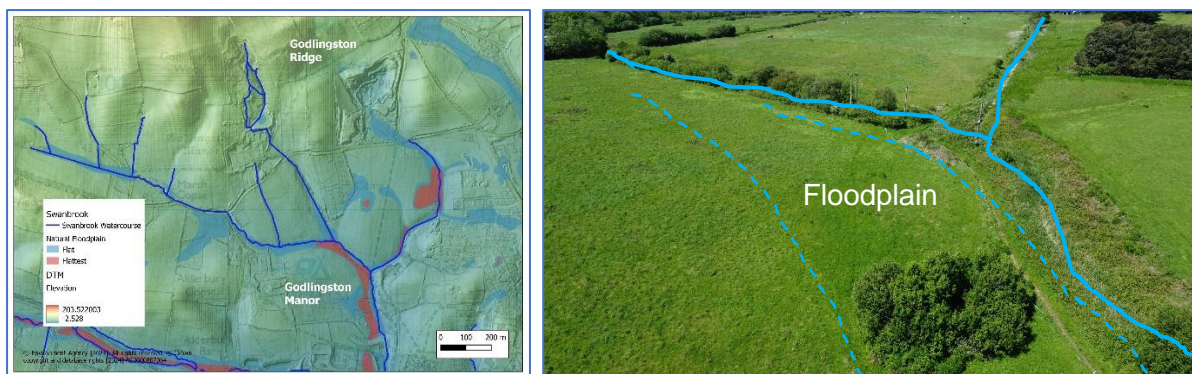
5. Godlingston Manor Farm

Surface Water Drainage and Topography

The site at Godlingston Manor Farm is at the confluence of two tributaries. Both tributaries receive spring derived flow combined with storm runoff during rainfall events. The channel for both tributaries is modified including straightening and realignment. The resultant cross section of the channels are over deep and incised.

A review of the local topography at the site can define a floodplain area for the streams which is up to 45m wide. Analysis of the Environment Agency LiDAR DTM to identify areas of flatness within the landscape can be considered to define the natural floodplain where water will occupy due to gravity. Flatness is defined as a measure of slope combined with elevation which is then classified. The figure below shows where the flattest land is classified (red) and its association with the tributary channels. The light blue shaded areas represent flat levels which are at the fringes of the floodplain or are associated with the tributary inputs to the floodplain but have a slight slope.

Comparing the pathway of the tributary channels to the potential floodplain area shows that the channel has become detached from the floodplain and is currently perched (following an elevated course) above the floodplain.

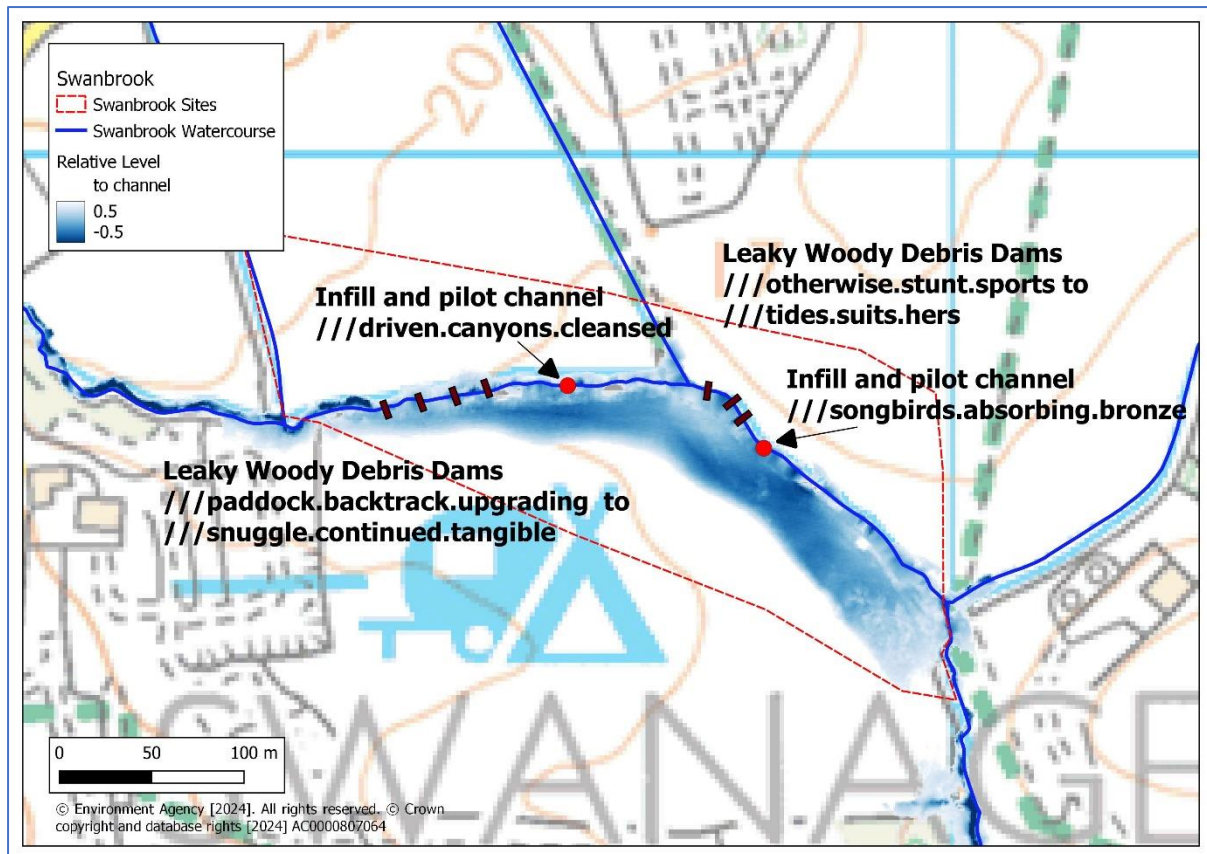


Approach to working with natural processes.

Currently the realigned and over deep nature of the channels means that flow is retained within the channel rather than overbank flow connecting onto the floodplain where velocity is reduced, and storage created. Maintaining flow within the channel is an efficient transport and increases flood risk downstream. Where possible opportunities should be sought to increase storage within the catchment and on available floodplain.

At Godlingston Manor, there is an opportunity to reconnect the flow from the tributary channels to their floodplain.

The approach at Godlingston Manor Farm will be to slow flow and reconnect the available floodplain area. A summary of proposed measures is shown below.

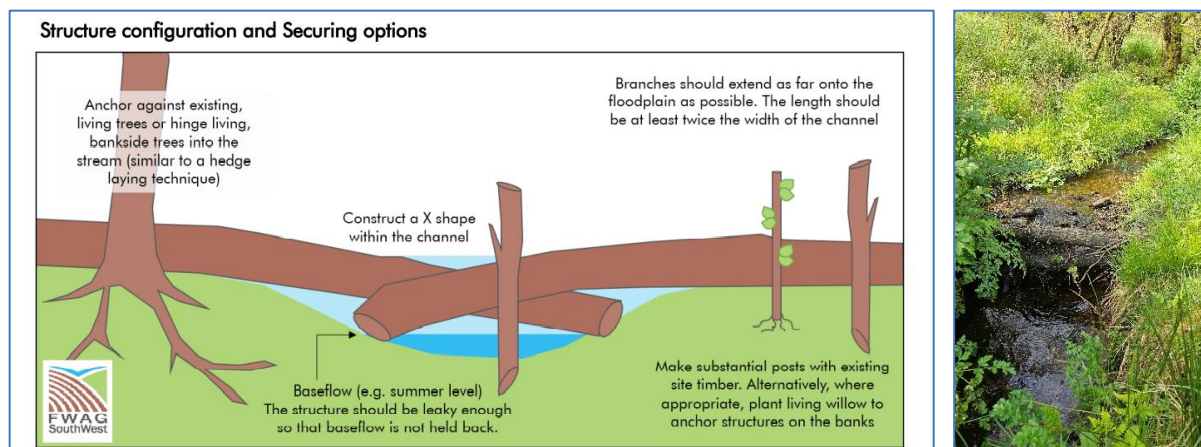


Natural Flood Management Opportunity – In channel slow flow

The incised form of the channels of both tributaries is part of the reason that the floodplain has been disconnected. Addition of woody debris to the channel is proposed specifically with the intention to trap sediment and raise the bed level of the channel. The woody debris as a leaky dam will also raise water level but at the locations proposed there is a limited floodplain space.

Two reaches are proposed, with addition of up to 3 to 4 dams per location (see figure above).

A basic design of woody debris in the channel is shown below along with an example.



The leaky woody debris dams will be installed manually. Works will be undertaken using a chainsaw and debris manually manoeuvred into place. Any fixings will be manually installed.

The approach to installation will be:

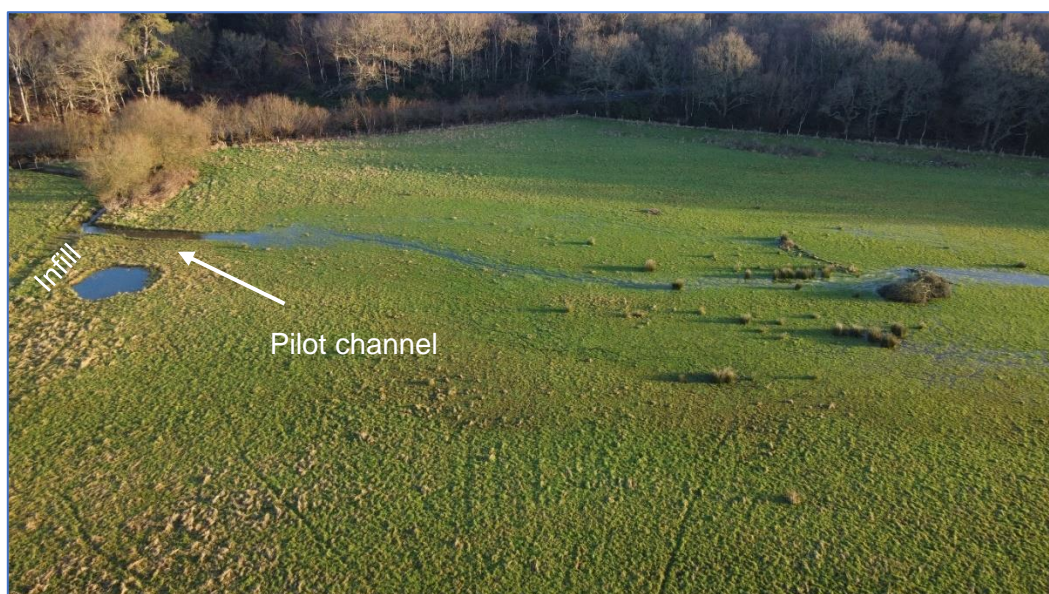
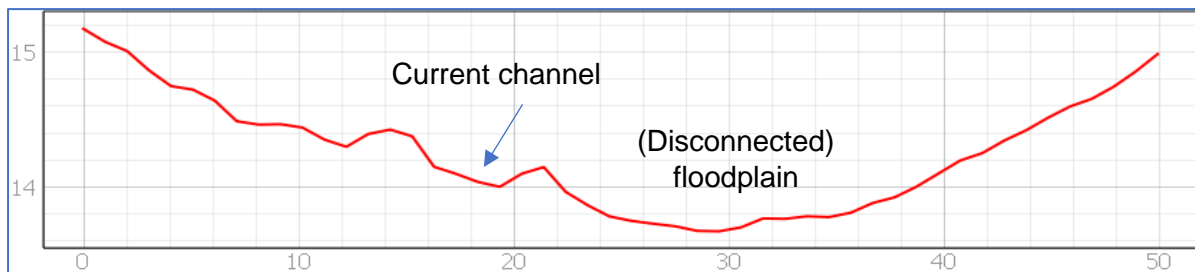
- Fell with no hinge so that the tree is detached from the stump (requires staking of the trunk or securing to other trees on bank);
- Secure the trunk, with stakes made from local durable wood;
- Stakes securing the tree should be on the downstream side, angled so the top of the stake is pointing upstream and $>0.1\text{m}$ above the top of the felled tree;

Where stakes are used to secure the tree to the river bank and retain in-channel, the wood will be attached to the stake to minimise the risk that the tree floats away.

Natural Flood Management Opportunity – Floodplain reconnection

The analysis of flatness in the valley floor identifies the potential natural floodplain. Comparing to the course of the tributary streams it is clear that the channels have been realigned outside of the floodplain area. It is proposed to re-connect the tributary streams to the floodplain.

The points at which the channels deviate from the floodplain has been identified and will be the reconnection point. A simple infill of the channel is proposed at these locations. It is anticipated that there will be locally won availability of material to infill the channel. There is some evidence of an embankment along the channel (see below) but also it will be necessary to create a shallow pilot channel to direct flow onto the floodplain area (see example below). Material from the pilot channel can be used as infill. The infill should be immediately downstream from the reconnection point and only need to be for a distance of 10 to 20m.



The downstream of the newly reconnected floodplain area is currently modified for use as floodplain storage. The storage area appears to work with a narrowing of natural valley form topography. Re-connecting the floodplain from the two tributary channels will make the current storage feature an on-line wetland feature. A wide and shallow diffuse flow will be created on the floodplain as the main flow path of the stream rather than the feature acting only as a storage feature.

There is no obvious engineering at the downstream end of the floodplain to hold water and it appears flow has a shallow connection back to the current single channel. The shallow connection will be the return of flow from the floodplain to the single channel for ongoing flow downstream of the floodplain connection.



Considerations

It will be key to liaise with the Environment Agency. The tributary stream itself at the point of reconnection is not classified as Main River but the reconnection point and potential modification of the floodplain storage area are in a reach classified as Main River. The floodplain reconnection will be a change in supply of flow to the storage area and modify the functioning of the feature.

A public footpath currently follows the western (right bank looking downstream) side of the tributary channel. The footpath will need to be re-routed along the eastern (left bank) to join an existing upstream crossing point for onwards passage to Godlingston Manor Farm.