

4/23/2025

Lottice Brook Restoration and Wetland creation at Brookside

Ribble Rivers Trust RRT178

Date: 12/08/2025

Authored by: Abigail Gunson – Project officer

Checked by:

RIBBLE RIVERS TRUST

Contents

Introduction	3
Site description and condition assessment.....	3
Suggestions	5
Overflow channel/swale	5
Wetland creation.....	6
Creation of open water habitat/floodplain.....	10
Revetment Removal	12
Leaky dam construction	13
Addition of natural material.....	13
Natural recovery.....	14
Access recommendations	15
Erosion mitigation	17
2-stage channel construction	18
Implementation plan.....	19
Priority Wetlands	19
Priority Revetments	23
Priority Large Woody Material	24
Priority Channel Works	25
Priority Erosion Mitigation	27
Additional Considerations	27
Summary table	28
References.....	28

Introduction

This river restoration feasibility study has been prepared to develop an understanding of the condition of Lottice Brook in Brookside. It will propose restoration interventions which may improve the condition of the watercourse and accessibility of the site. This feasibility study is part of the Brookside Restoration Project funded by the Climate Action Fund (CAF) which is administered by the National Lottery Heritage fund, the criteria of CAF will equally inform the recommendations to ensure the desired outcomes can be achieved.

The primary aim is to consider options for river restoration and wetland creation for Lottice Brook to improve the water environment of Brookside. We considered options for the entire river corridor which includes the watercourse and its adjoining floodplains.

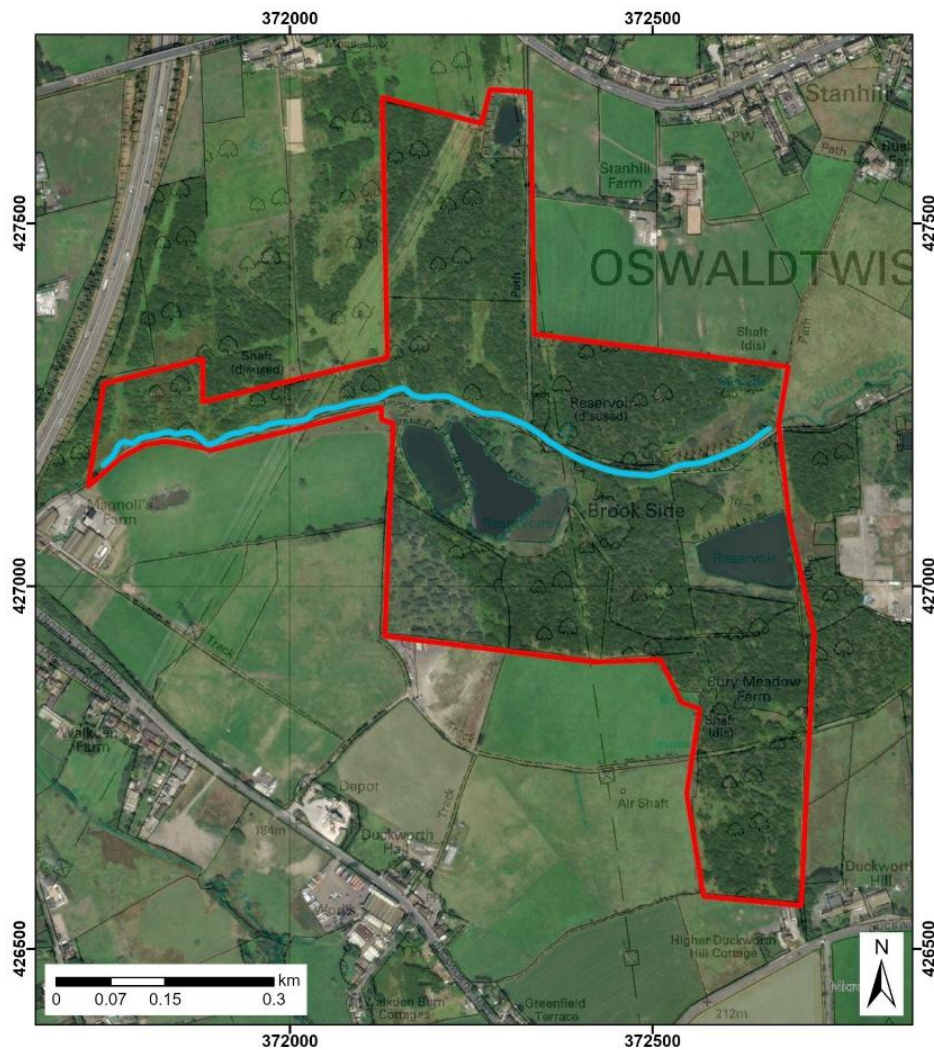
A walkover of the site was conducted to establish the condition of the site and identify areas of concern or areas that have the potential to be improved and how. Habitat surveys conducted by the Wildlife Trust will inform some of these recommendations.



Site description and condition assessment

The main watercourse at the study site is Lottice Brook (figure 1) which is a tributary of the Hyndburn waterbody in the Calder catchment, originating at the confluence of Tinker Brook and White Ash Brook northwest of the Leeds and Liverpool canal. The watercourse has intermittent revetments installed on both banks that restrict any form of meandering or flow diversity, in other areas there is active erosion in close proximity to the path. Re-naturalisation and re-meandering of the river and its habitat has occurred at some points along the watercourse and there is evidence that areas of wetland are naturally developing, in these cases, little intervention will be needed.

Additionally, there are some areas of outfall along the length of the brook attributed to multiple factors such as the nearby motorway, the abandoned mine or remnants of landfill contamination.

Brookside consists of a number of disused reservoirs, two north of Lottice Brook have been drained and rarely store water in dry periods, the 5 south of the brook, including an overflow area, vary in water quality and habitat quality, ranging from seemingly very polluted (visually very turbid) to clear and supportive of diverse invertebrate and bird species.



	Area of interest
	Lottice Brook

Author: Abigail Gunson
 Project: Brookside Climate Action
 Date: 08/04/2025
 Coordinate System: British National Grid
 Scale: 1:6,500



Some or all of the following statements apply: Contains public sector information licensed under the Open Government Licence v3.0. Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and/or database right 2019. All rights reserved. © Natural England. Copyright and database rights 2019. Contains, or is derived from, information supplied by Ordnance Survey and Rural Payments Agency. © Crown copyright and database right 2019. Ordnance Survey Licence number: 100022021.

Figure 1 Lottice Brook watercourse through Brookside

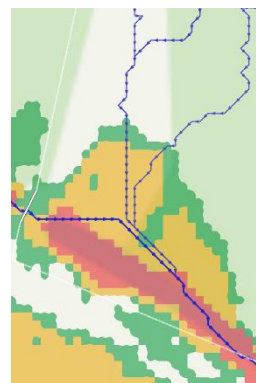
Intervention suggestions have been listed with justifications for why they have been recommended. Decisions to implement the interventions would be subject to funding and ultimately, how much they align with the goals of the project. The benefits and possible risks of each intervention will be raised, and key features of the site highlighted with the relevant interventions, not all of the proposals will be feasible.

Suggestions

Overflow channel/swale

The bridge crossing at the centre of the brook (figure 2) is a major access point for visitors of the reserve but is prone to flooding. Over time it has become uneven because of water flooding out of the brook as well as the path to the north, this has resulted in the erosion of previous attempts to level out the path.

There is potential for the construction of an overflow channel or swale on the east side of the path reaches the brook and instead redirecting the water to a depression on the left-hand bank of the brook (marked in this extract from Scalgo live) where there is already evidence of a flow path through the vegetation (figure 3) that leads into the brook.



This opportunity would reduce the risk of further degradation of the crossing, filling the depression in times of flood. This would allow the surface of the crossing to be repaired and improve accessibility of the site to wheelchair users, prams and those with mobility issues. However, this would only influence water running from the top of Stanhill road and the channel flood water may ultimately continue to flow over the bridge and cause similar issues.

An overflow channel might also be beneficial at points of the reservoir that flood over the side of the reservoir bunds. The water can then be redirected to the potential floodplain or wetland areas rather than left to chance.



Figure 2 - Crossing over Lottice Brook



Figure 3 - Evidence of flow path into the brook



Figure 4 - flooding over reservoir sides

Site images of overflow channel potential

Wetland creation

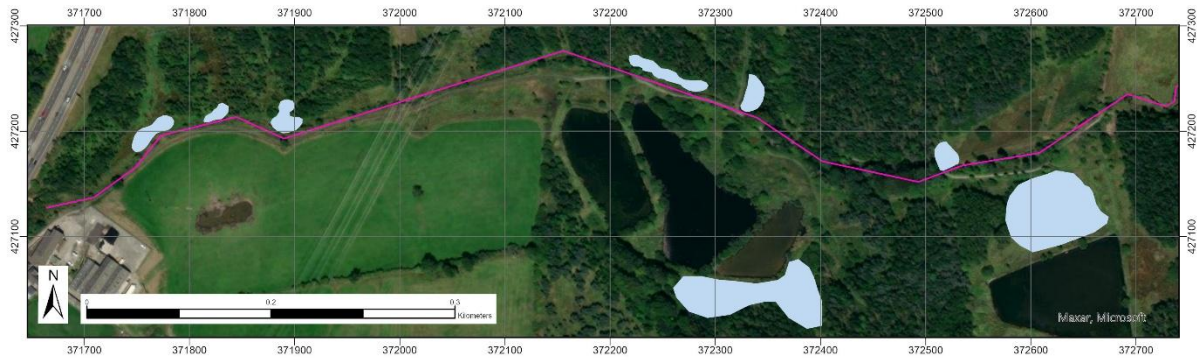


Figure 5 Wetland opportunities

There are several areas along the brook with wet conditions and a significant presence of rush (*Juncus*). This presents the opportunity for wetland creation in these areas of prolonged boggy ground conditions, depressions adjacent to the brook and vegetation that can survive in waterlogged soil and subsequently enrich it.

Establishing wetlands will enhance the current riparian habitat and allow these areas to support a wider variety of vegetation and wildlife. An additional bonus to wetland vegetation is the natural filtration, which would then improve the quality of water. It would also function as additional water storage during heavy rainfall and flood events, providing an element of natural flood management.



Figure 6 SD71759 27180



Figure 7 SD71892 27219



Figure 8 SD72236 27264

Site images of potential wetlands



Figure 9 Map of wetland opportunities: Wetland 1 (W1), Wetland 2 (W2), Wetland 3 (W3). Thinner blue lines represent flow paths into Lottice Brook (Thicker line), data collected from SCALGO live. Purple shapes represent depressions in the ground.

Wetland opportunity 1: SD71759 27180

The first opportunity presents itself immediately by the motorway outfall where the channel has revetments and a laid bed. The water quality in this area is poor and likely has little ability to regulate water levels during high flow events. The land on the left-hand side of the brook has the potential for wetland creation with three flow paths entering from Lottice brook and flat surface area with no obvious sandy or gravelly soil although testing the soil properties would help determine its current and potential water retention capacity. A wetland in this area would likely address water quality and flood storage issues, and improve the quality of water downstream. The Lancashire Wildlife Trust have suggested that tiered filtration bed with planted *Phragmites* and *Typha* could be an effective solution to take in excess rainwater and filter the motorway runoff before the water enters the brook. A potential challenge to the creation of a wetland area here would be the lack of space and natural depressions in the area, which would limit the ability of the area to naturally collect and hold significant volumes of water which would ultimately maintain the wetland habitat.

Wetland opportunity 2: SD71832 27217

Downstream of W1 there is a small area that was observed to have some degree of water retention. This would support the creation of a small, wooded wetland that would benefit the quality of the water in the brook, especially given that just upstream of this location there was a second drainage outfall with signs of sewage fungus. Later in this report there will be a

recommendation of a 2-stage channel just upstream of W2 which could pair well with a small wetland to help store more water from the brook. Similar to W1, W2 does not have any natural depressions so could potentially struggle to hold significant volumes of water as well as having some observed sandy qualities to the soil adjacent to the brook that would make water retention difficult.

Wetland opportunity 3: SD71892 27219

The third area for a potential wetland is located by an obvious depression on the left-hand bank of the brook. The land is generally quite flat and already supports a population of basic wetland vegetation (*Juncus*) as well as having a natural depression that already functions to hold water from the flow paths. The potential also extends into the established woodland. The size drawn on the map is more of an estimate and is likely unrealistic for any initial wetland creation as the flow path veers slightly more east to where the depression is so without the additional input of water it is unlikely it would be regularly flooded to the extent of a wetland.

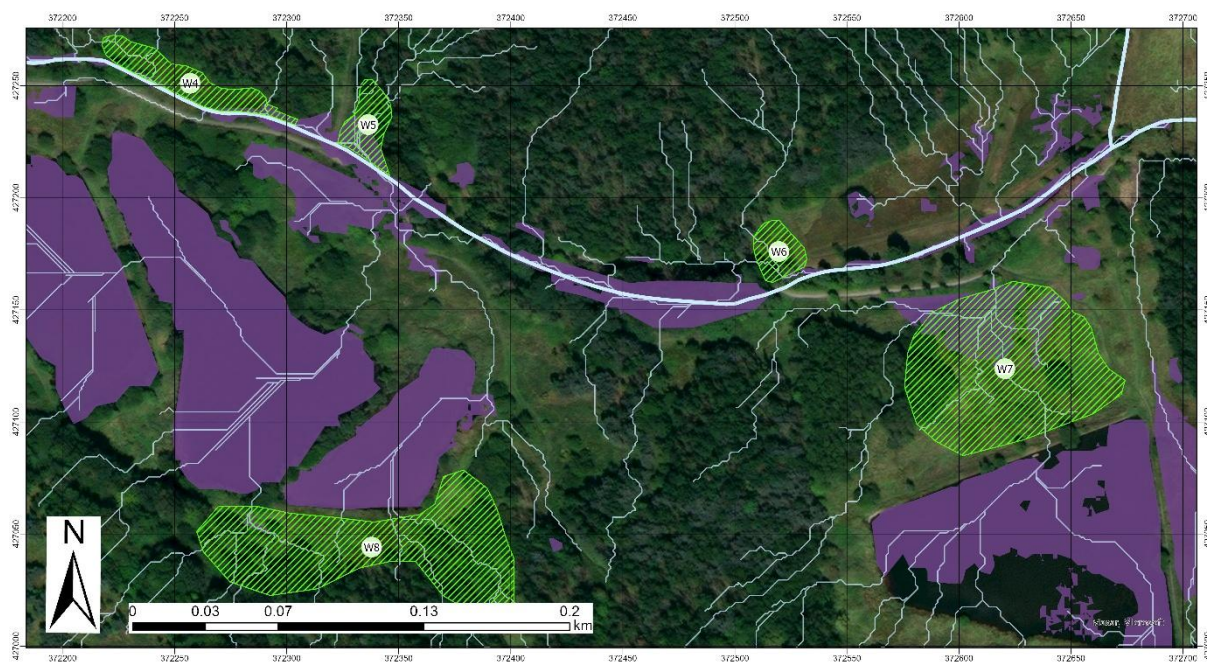


Figure 10 Map of wetland opportunities: wetland 4 (W4), Wetland 5 (W5), Wetland 6 (W6), Wetland 7 (W7) and Wetland 8 (W8). Thinner blue lines represent flow paths into Lottice Brook (Thicker line), data collected from SCALGO live. Purple shapes represent depressions in the ground.

Wetland opportunity 4: SD72236 27264

W4 has been suggested as a potential wetland/wet woodland stretch as it has a few suitable wetland features including wet/inundated ground, multiple flow paths and wetland vegetation. The area would also benefit from wetland creation as the brook channel has stone revetments on

both banks which reduce its flood water storage capabilities and small volumes of seepage from the lodges which likely influences the quality of the water in the brook.

Wetland opportunity 5: SD72327 27226

Adjacent to the path coming from Stanhill road, there is a depression in the ground as well as evidence of flow paths leading into the brook. An overflow channel has already been recommended for this location, but the creation of a wetland would be an additional benefit, subsequently improving the water storage properties in the area and would then further reduce the erosion of the bridge by storing the excess water from the new channel and the brook during flooding events.

Wetland opportunity 6: SD72522 27173

W6 is located just before the smaller of the two drained reservoirs that are rarely inundated with water during dry periods. The smaller reservoir is dominated by Reedmace and provides a valuable habitat for invertebrates. The addition of an accompanying wetland could potentially mediate the reedmace dominated habitat and introduce a higher diversity of wetland vegetation by redirecting and holding additional water from the flow path to the west of the reservoir.

Wetland opportunity 7: SD72642 27101

This area is already an overflow area for the large reservoir to the east that is regularly inundated with water spilling over from the reservoir. The area exhibits characteristics of a fen habitat or, at the least the potential for one: waterlogged soil, rushes and reeds, marsh vegetation such as southern marsh orchid, marsh marigold and common valerian. This area can be enhanced by removing strips of silt and adding natural material to increase the area of wetness as well as cutting and removal of vegetation on the embankments to restore species richness of positive indicator herbs such as heath bedstraw and bilberry. If the intention with this area is to allow succession/natural processes to take place it is likely to become a wet woodland or willow scrub overtime. The reservoir has been surveyed by the Lancashire Wildlife Trust and considered to be in poor shape. There is overflow from a raised manhole tower, which contribute to a significant volume of excess water. There is also a small area within the highlighted section for W7 that has been recorded to be permanently dry acid grassland (grid reference SD 72639 27152) that would benefit from remaining dry, so the proposed wetland should function to also redirect water from this area.

Wetland opportunity 8: SD72512 26942

Like W7, W8 is already regularly inundated with water and has fen-like characteristics. The major issue with this area is the poor quality of the water that feeds it, both from the lodge adjacent to it but also from a small spring that seems to be rich in iron oxide. Creating more open wetland by digging out slits and relocating the soil into the riparian woodland as well as planting filtering vegetation such as *Phragmites australis* could help improve the quality of the water and enhance the condition of the wetland itself. Concerns have been raised by members of the public and partners of the project about the stability of the ground in this section as there are several exposed/collapsed drains that are quite deep, this might make it unfeasible for machinery to access the location or could increase the risk of injury to the general public.

Creation of open water habitat/floodplain

The drained and defunct reservoir is periodically inundated with water by both the brook, during flooding events, and a natural spring in a field to the north that floods the footpath in extensive rainfall. It also supports populations of various riparian vegetative species. The raised bunds have become less species rich over time but have previously been able to support acid and neutral grassland species.

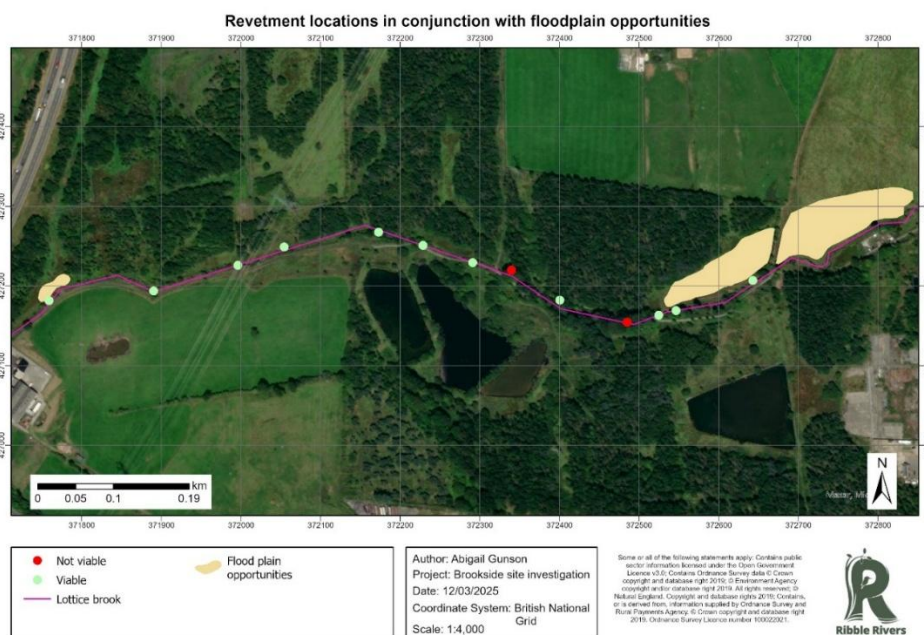


Figure 11 Map indicating points along Lottice Brook with revetments and associated potential floodplains

A floodplain or open water habitat would be a suitable opportunity for this area, as it will enhance the current habitat for invertebrate and amphibian populations as well as providing additional water storage during flooding events and potentially reduce the frequency of flooding events that occur.



Figure 12 SD72361 27203



Figure 13 SD72648 27211

Images of potential floodplains

Floodplain option 1: SD71759 27180

An alternative option to a wetland in this location would be to connect the brook to a floodplain. The section adjacent to the brook is low lying and could make a suitable connecting floodplain if the wetland option is not desirable. A floodplain would be appropriate mitigation for the laid walls and bed of this section of the brook that might be vulnerable to flooding.

Floodplain option 2: SD71784 27200

The second option is located where there is active erosion and signs of natural recovery and reconnecting the brook to the land to create a more open habitat that is readily accessible for flood water to spill into. A floodplain in this location would pair with wetland opportunity 6 to mitigate future flooding, improve groundwater recharge and increase biodiversity and habitat quality.

Floodplain option 3: SD72648 27211

The third opportunity lies just outside of the Brookside Climate Action area of work however it is worth highlighting that the field has the potential to be enhanced for the benefit of the project and the landowner. Between F2 and F3 there are revetments lining both banks of the channel; however, the channel itself is meandering and the land on the left-hand bank is already a connected, low-lying floodplain. There is potential to improve the condition of the floodplain by removing the revetments, planting native wet vegetation, potentially fencing the area off from stock, and enhancing the land into a habitat corridor.

Revetment Removal

Several sections along Lottice brook are lined with stone wall and bed revetments that inhibits the natural shape and flow of the watercourse. Some of the sections of the watercourse would benefit from the removal of the revetments (see the provided map for opportunities for removal).

The removal of these revetments would reconnect the watercourse with its associated floodplain and ultimately improve the functionality of the brook's natural flood management. It would also encourage the re-meandering of the brook into a more natural state and introduce some variability to the flow.

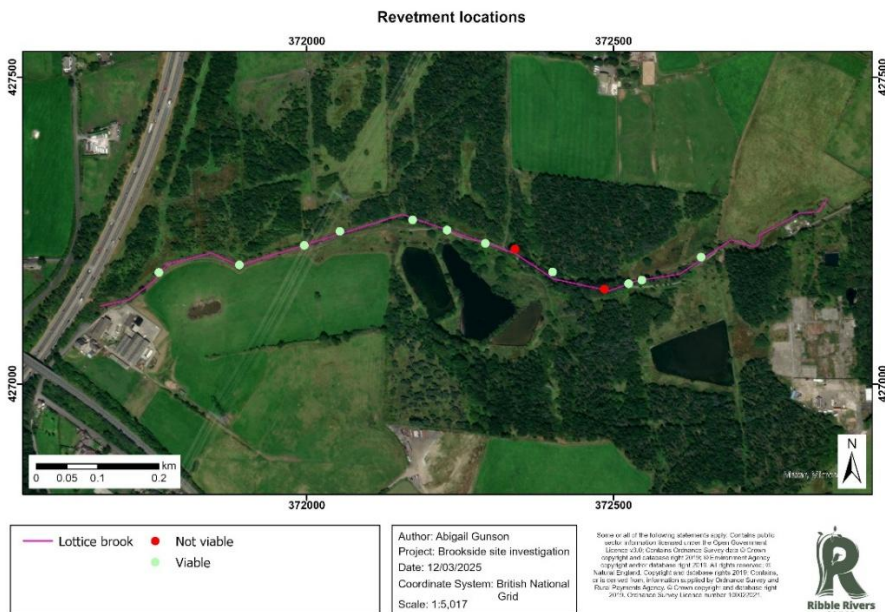


Figure 14 Map indicating revetment locations. Red locations are not an option for removal due to historical structure or mature tree



Figure 15 SD71759 27180



Figure 16 SD71790 27203



Figure 17 SD72236 27264

Images of laid bed and walls

It should be noted that some locations will not be viable for revetment removal. There may be historical value or complications due to the presence of mature trees and culverts, so alternative actions may need to be considered in these areas.



Figure 18 SD72340 27220, Example of revetment location where removal will not be viable.

Leaky dam construction

There are long stretches of the brook that lack variability in shape and flow. This increases the risk of erosion and flooding problems but also reduces the quality and diversity of the habitat for aquatic organisms. For instance, Lottice Brook has low numbers of riffles and pools, features that create more complex habitats for a more species rich invertebrate population. Pools are also areas where migrating fish will be able to rest in and therefore improve their chances of survival.

The construction of leaky dams at certain sections of the brook would introduce variable flow patterns by slowing the flow of the brook and holding back significant volumes of water. Not only will this encourage the river to take a more natural shape, but slowing the flow will ultimately improve the holding capacity of the brook during high flows and potentially reduce the severity and frequency of flood events.



Figure 19 Example of a functioning Leaky dam holding back water (image credit Vicky Whitworth

<https://www.bitesizedgardening.co.uk/leaky-dams-aka-porous-check-dams/techniques/>)

Leaky dams should be placed in reaches of the beck where they will not contribute to additional flooding or erosion of infrastructure. These will be locations where the brook is a fair distance from the path or from bridges. The specific locations can be assessed on site.

Addition of natural material

Alternative and less intrusive options to leaky dam construction would be the addition of natural materials to the watercourse. material such as tree trunks, root plates, fallen living and dead wood would also encourage flow diversity in a way to mimic the natural state of a watercourse.

This would benefit the watercourse in a number of different places. The material would encourage geomorphic recovery of the channel by interrupting and changing the direction of the flow of water and causing it to scour the bed, deposit coarse sediment and erode the banks in places, creating pools, riffles and meanders. The material would provide additional habitat and source of food for aquatic invertebrates and potentially small fish.

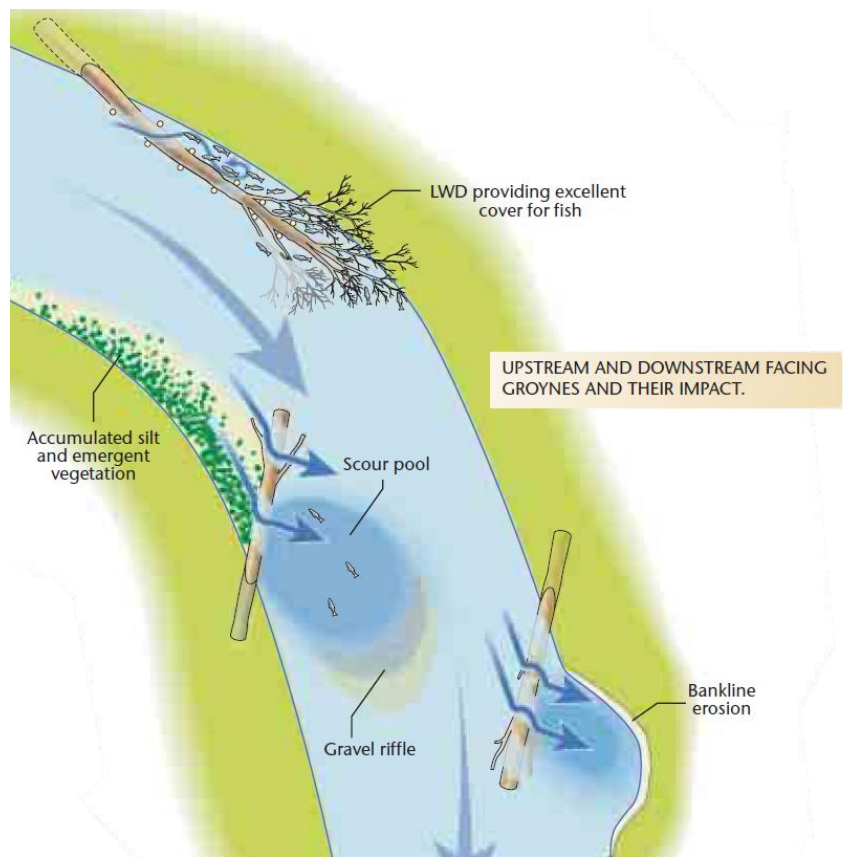


Figure 20 Diagram highlighting the influence of natural material (Large Woody Debris (LWD)) on a stream. Diagram acquired from the Wild Trout Trust Chalkstream habitat manual.

Natural recovery

There are some sections of the river that exhibit some degree of natural recovery without human influence. These are areas where there are no structures such as wall revetments and where trees and woody debris have fallen into the river, the natural process that the previously mentioned leaky dams mimic.

In one instance, by the eastern reservoir, pipes and eroded structures have, over time, held back enough water for the area around it to become seasonally inundated with water and develop wetland/fen characteristics. Some natural remeandering is also taking place along sections of the brook.

In these areas, doing nothing with the watercourse may be the most beneficial option given that it is seemingly changing for the better without human intervention. Allowing the habitat to naturally recover would cost nothing and additionally would not produce any construction-related carbon-emissions or disturbance to the ecology or geology of the watercourse or the surrounding land.

This would be a long-term option that would have no short-term or immediate changes or additional benefits to biodiversity and flood mitigation other than what can naturally occur.



Figure 21 SD71838 27210



Figure 22 SD71759 27180



Figure 23 SD71890 27192



Figure 24 SD71964 27224



Figure 25 SD72642 27101



Figure 26 SD72642 27101

Evidence of natural recovery

Access recommendations

The footpath behind the reservoir is regularly inundated with water and overgrown with vegetation, making it less accessible to visitors of the site. Additionally, the bridge crossing at the bottom of Stanhill road (mentioned in the overflow channel/swale section) has eroded and become uneven, and as the main entrance to the site for those with mobility issues, it has become a cause for concern. Other areas of crossing for walkers are either unintentionally created (ie desire lines and dog tracks) or unstable (loose stone cobbles). There is also no official crossing for horse riders, which has led to high volumes of foot traffic through the river.

A number of different options can be considered here. A wooden boardwalk could be installed to replace the footpath behind the reservoir. the boardwalk would be elevated so that during periods when the ground is flooded, the route is still useable by visitors. This would also allow the habitat around the boardwalk to remain a wet area without inhibiting the use of the site by visitors.

The bridge at the bottom of Stanhill road is susceptible to erosion from the periodical flooding, the excess water washing away the top surface and leaving it uneven. Re-surfacing the bridge (in combination with the overflow channel) would resolve the issue of inaccessibility and reduce the risk of further erosion.

In areas where there is evidence of regular crossing, wooden footbridges would be suitable to reduce the foot traffic and subsequent erosion of the banks of the brook. Consideration must be given to the potential for the bank to erode and destabilise the structural integrity of any footbridges installed.



Figure 27 Footpath behind reservoir

Finally, a track can potentially be dug out and stabilised upstream where the banks have already eroded because of regular foot traffic. This path would hopefully encourage visitors to cross at this designated location to minimise the damage along the entire length of the brook.



Figure 28 SD72568 27174



Figure 29 SD72568 27174

Areas of potential footpaths

Erosion mitigation

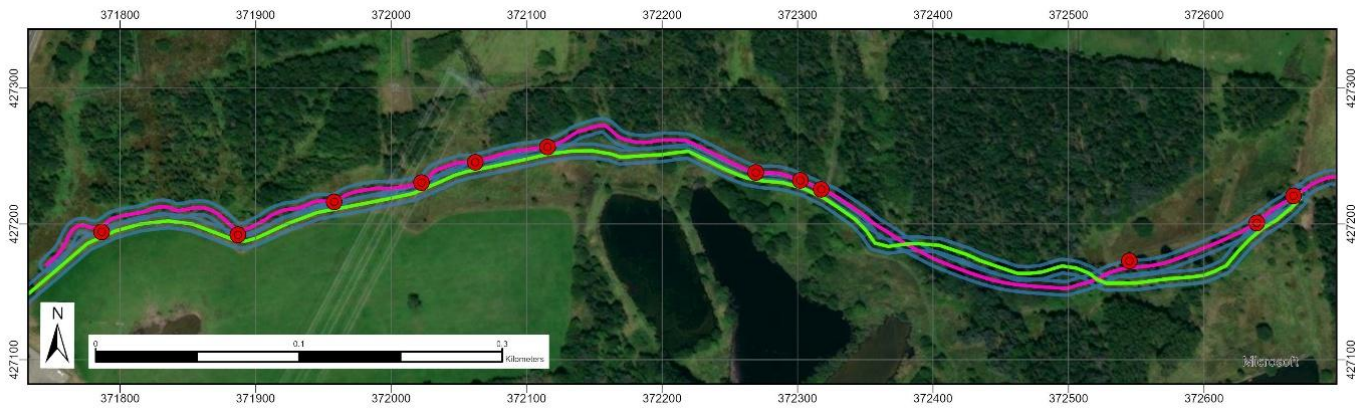


Figure 30 Map identifying locations where the banks of the brook have eroded within 5m of the footpath

At certain sections of the brook, the bank has eroded very close to the fence/path which poses a risk to the safety and stability of the main footpath. The below figure identifies locations where the distance between the brook and the footpath is 5 metres or less, and as such any further erosion could eat into the footpath.

Interventions such as willow staking and brash bundles would be suitable to mitigate any further erosion of the bank as the roots would stabilise the bank edges. Overtime the willow and brash material will improve the integrity of the banks and reduce the risk of further erosion.



Figure 31 SD71784 27200



Figure 32 SD71890 27192



Figure 33 SD72545 27174

Locations of active erosion

2-stage channel construction

In places, the brook is very uniform in both geology and ecology as a result of the bank revetments and sewage outfall. This has led to poor aquatic and terrestrial habitat as well as higher risk of flooding as there is nothing to slow the flow or store the excess water during high rainfall events.

At SD71790 27203, the creation of a simple profile 2-stage channel would be suitable as the revetment and drainage limits the viable opportunities for improvement. The 2-stage channel will act as a small-scale floodplain to compensate for the discharge during high flow events to prevent flooding over the banks. It will also provide additional, more diverse habitat within the constraints of the channel.

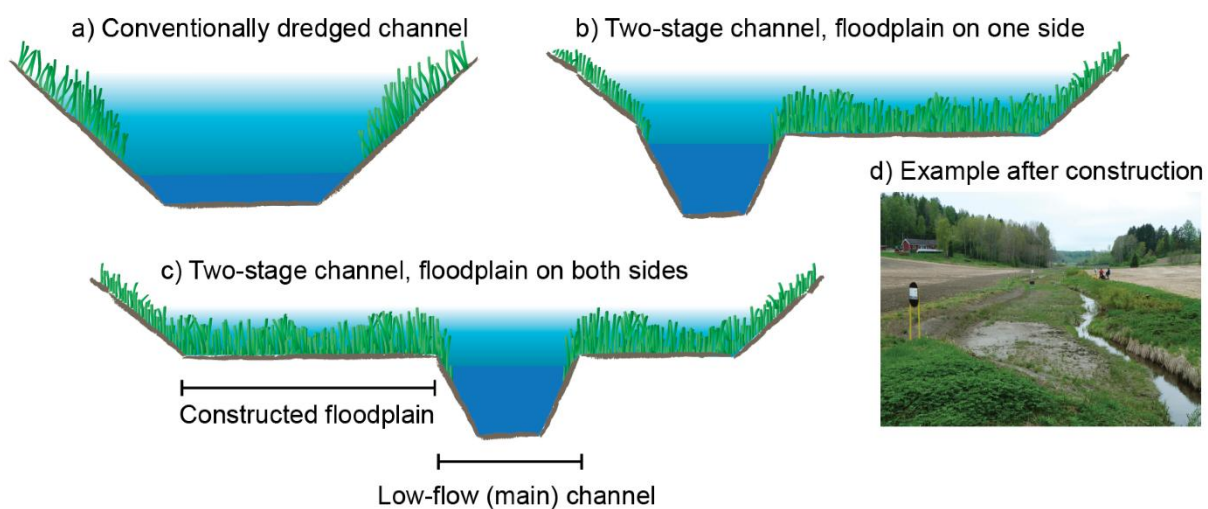


Figure 34 Typical cross sections of conventional channel compared to 2-stage channels and an example after construction. **B** would be recommended for Lottice Brook. (Vastila et al, 2021)

Implementation plan

A final visit to the site was conducted to identify the interventions that should be prioritised and delivered first and the stages for implementing each intervention. These interventions would likely be the foundation for natural recovery along the brook and at the very least they would help the brook become more resilient to changes from pollution or climate. The opportunities not mentioned in this section should not be discounted as they would still be valuable improvements to the site for future projects.

Brookside RRT Implementation plan

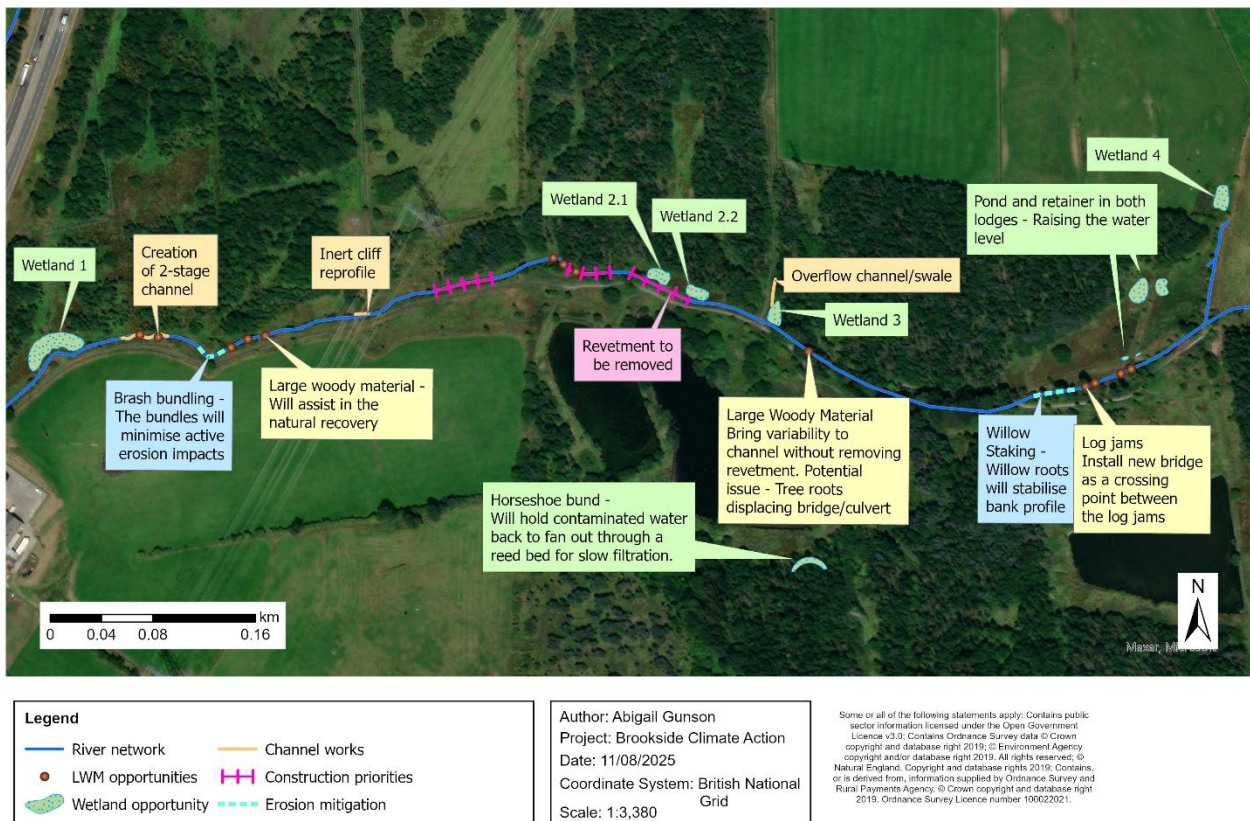
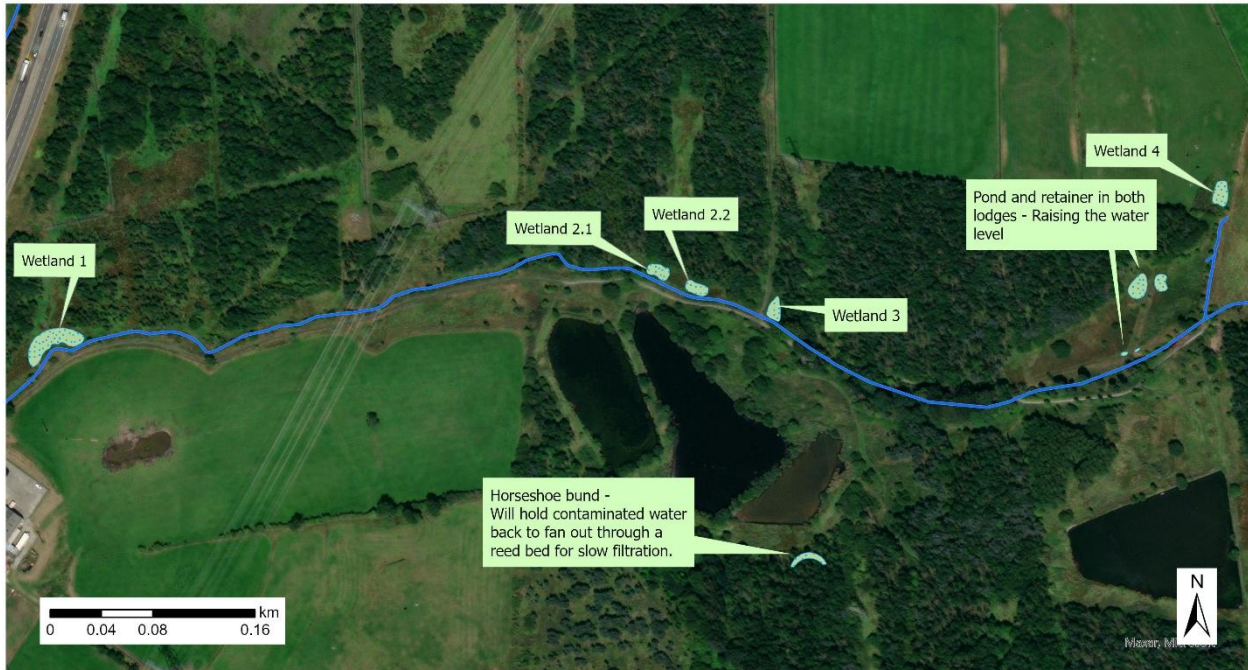


Figure 35 Brookside Implementation map

Priority Wetlands

The locations that were identified to be the most suitable for wetland creation were chosen with the criteria that they would be the most beneficial for the health of Lottice brook when implemented. These wetlands would help improve the overall resilience of the brook by focusing on spill points and areas with known water quality or flooding issues.

Brookside RRT Implementation plan



Legend

- River network
- Wetland opportunity

Author: Abigail Gunson
 Project: Brookside Climate Action
 Date: 11/08/2025
 Coordinate System: British National Grid
 Scale: 1:3,380

Some or all of the following statements apply: Contains public sector information licensed under the Open Government Licence v3.0. Contains Ordnance Survey data © Crown copyright and database right 2019. © Environment Agency copyright and database right 2019. All rights reserved. © Natural England. Copyright and database rights 2019. Contains, or is derived from, information supplied by Ordnance Survey and Rural Payments Agency. © Crown copyright and database right 2019. Ordnance Survey Licence number 100022021.

Figure 36 Wetland opportunities from implementation plan

Wetland 1 – this is located by the motorway and septic tank outfall into Lottice Brook. The fundamental service that this wetland will provide will be filtration. The treatment wetland will intercept the points at which pollution runs into the brook, at the upstream end of the brook before running through brookside. This would be significant for the overall quality of the brook and relieve the pressure of any downstream flood mitigation by storing flood water and improving the capacity for Lottice brook to regulate excess water.



Figure 37 image showing the colour of the brook just after the motorway outfall. on the left-hand bank is the area for potential wetland

Additional benefits to a wetland in this location include increasing the diversity of the habitat. The downstream end of Lottice brook supports noticeably varied habitats whereas this location lacks any observable diversity. A healthy wetland will encourage a wider variety of species to inhabit Brookside or even just moving through. This wetland could act as an essential stepping stone for migratory species and improve the connectivity between different biodiverse hotspots for successful distribution.

This wetland would likely need regular maintenance until it becomes well established, especially if it is continuously fed polluted water. Despite the efficiency of treatment wetlands, it is possible for them to be

overloaded with continuous pollution, which is likely the case if both the motorway outfall and the septic tank are intercepted.

Spoil from the works can be placed nearby, potentially as low bunds to encourage motorway run off through the wetland itself.

Figure 38 demonstrates the value of having a wetland in this location, run off from the motorway will reach the treatment wetland before it enters the watercourse, therefore reducing the volume of polluted water entering the brook.

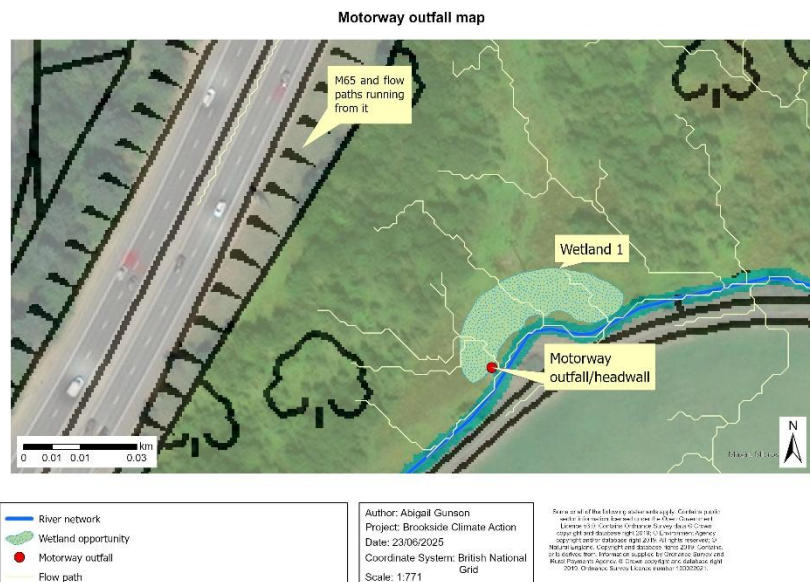


Figure 38 Flow paths intercepted by potential wetland

Wetland 2 – This location has characteristics that support the creation of a wetland. Due to the limited space to put spoil, the size of the wetland is limited, and so to maximise the impact of the wetland, it has been split into two smaller scrapes on either side of the area originally highlighted in Figure 10 (labelled as W4). The middle section will act as a transitional zone between the wet woodland and the brook.

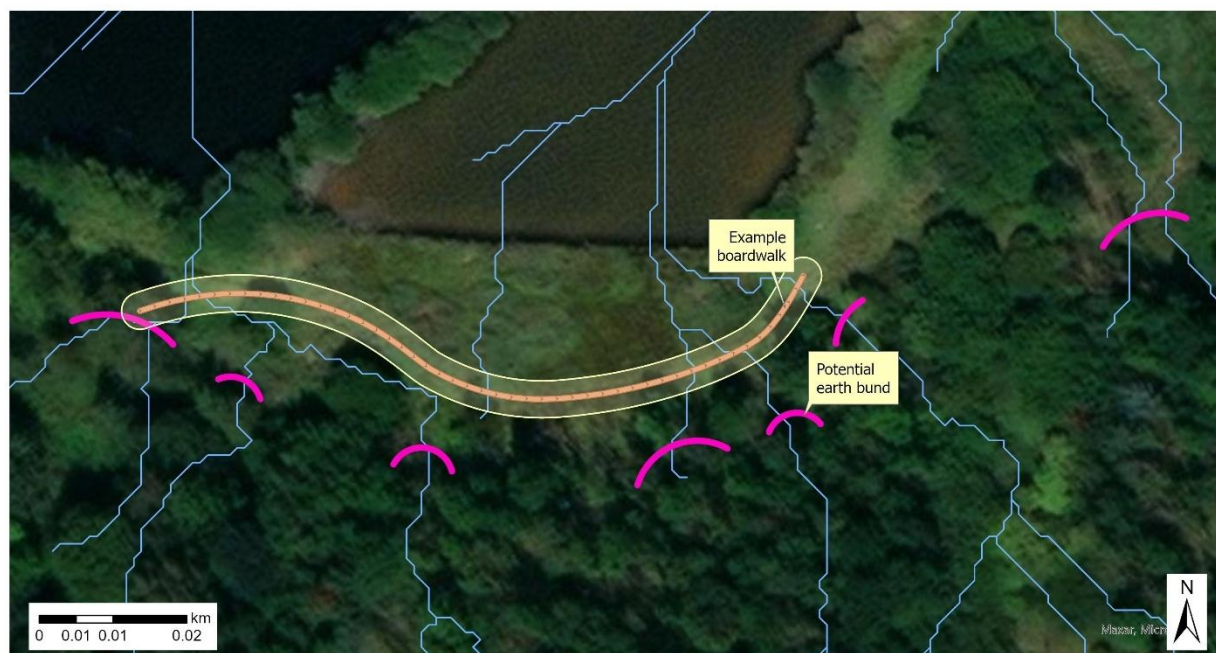
Wetland 3 – This wetland will likely be a 2-stage wetland, the water that enters will first flow through to settle in the wetland and then it will be slowly filtered out into the brook. There are different options for where to put the spoil from the works here that can be discussed closer to the time. This wetland will have the capacity to store the excess flood water flowing from the top of Stanhill.

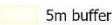



Wetland 4 – The wetland in this corner will be an attenuation and filtration pond to catch and hold run off from the farm uphill. The main use of land in this area is horse and sheep grazing which contributes to high nutrient run off into the brook. The area is species poor and dominated by a colony of Himalayan balsam. The pond will have two main functions: attenuation, to manage the excess rainwater, and filter the rainwater of runoff. Although this corner is outside of boundary for Brookside, the farmer has shown interest in the creation of the pond.

Horseshoe bund – The horseshoe bund option is dependent on the confirmation and location of the boardwalk on the southern end of the lodge the purpose of the bund will be to hold back contaminated water and slowly leaky it into a colony of *Phragmites australis* which would be beneficial to manually plant as currently the most abundant species is reed canary grass which does not have the same filtration capabilities. The figure below shows the potential locations for

the earth bunds based on satellite imagery and predicted flow paths that lead into the lodge.

Brookside RRT Implementation plan



	5m buffer
	Suggested boardwalk
	potential earth bund
	Flow path

Author: Abigail Gunson
 Project: Brookside Climate Action
 Date: 05/08/2025
 Coordinate System: British National Grid
 Scale: 1:587

Some or all of the following statements apply: Contains public sector information licensed under the Open Government Licence v3.0. Contains Ordnance Survey data © Crown copyright and database right 2019; © Environment Agency copyright and database right 2019. All rights reserved; © Natural England. Copyright and database rights 2019; Contains, or is derived from, information supplied by Ordnance Survey and Rural Payments Agency. © Crown copyright and database right 2019. Ordnance Survey Licence number 100022021.

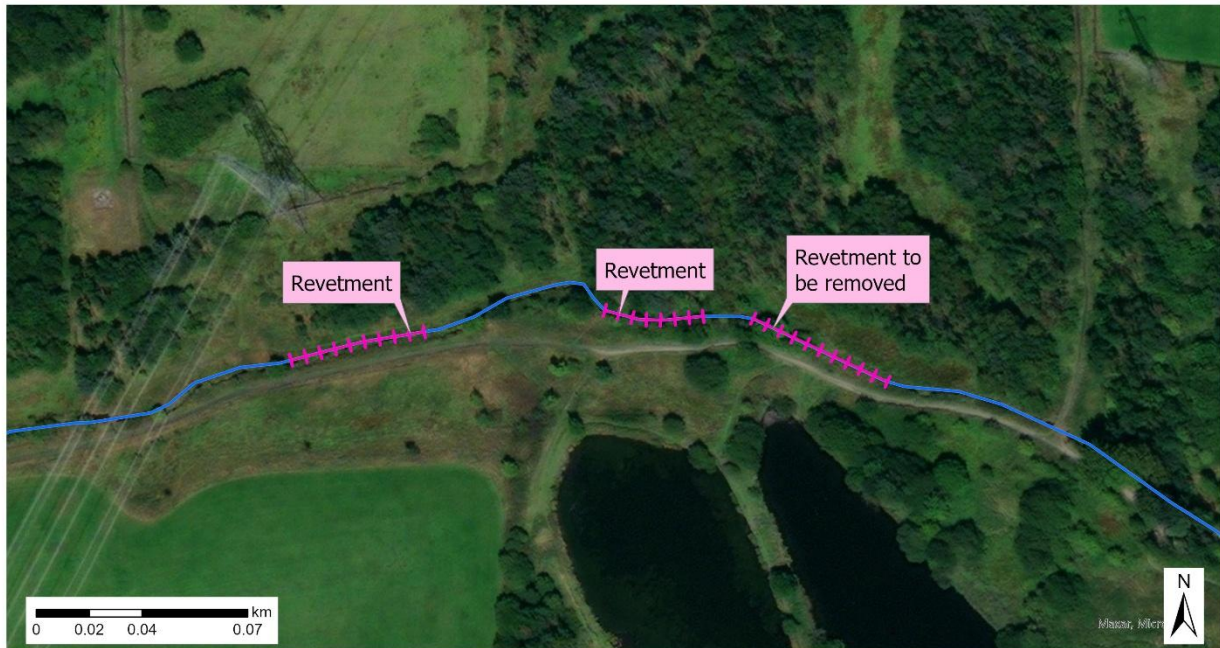
Figure 39 Suggested earth bunds that intercept the flow path into the lodge.

Pond and retainer - The two drained lodges at the downstream end of the site provide Brookside with some unique habitats that would benefit from rewetting. The western lodge is currently an unimproved grassland however there is indication of a more complex, diverse habitat in the form of flowering plants such as valerian and creeping buttercup as well as rushes and sedges. The eastern lodge is dominated by bulrush, which is a wetland species that prefers ground inundated with water. The creation of a small pond in each of these lodges would help address concerns of the area losing its value as well as hold more water before eventually leaking into the brook.

A retainer in the form of an earth bund or leaky dam would similarly help with rewetting the lodges and raising the water level. Previous interference has led to the lodges being drained and unable to store water. The creation of a small retainer and outlet where the lodges currently drain out of would assist in reinstating the original water level and support the storage of a high volume of water in the lodges.

Priority Revetments

Brookside RRT Implementation plan



Legend
River network
Construction priorities

Author: Abigail Gunson
Project: Brookside Climate Action
Date: 09/07/2025
Coordinate System: British National Grid
Scale: 1:1,434

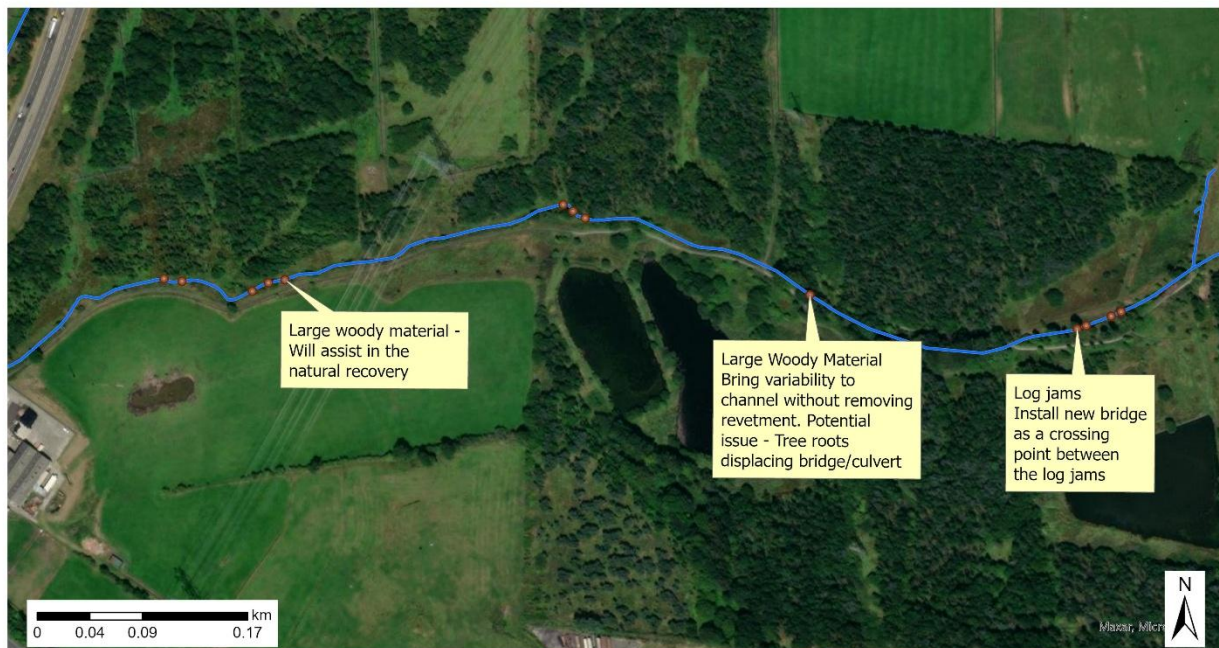
Some or all of the following statements apply: Contains public sector information licensed under the Open Government Licence v3.0. Contains Ordnance Survey data © Crown copyright and database right 2019; © Environment Agency copyright and database right 2019. All rights reserved; © Natural England. Copyright and database rights 2019. Contains or is derived from, information supplied by Ordnance Survey and Rural Payments Agency. © Crown copyright and database right 2019. Ordnance Survey Licence number: 100022021.

Figure 40 Revetments viable for removal

As previously mentioned, some revetments cannot be removed due to their location and the impacts that removal would have on the channel. The lengths of revetment that can be removed and should be prioritised are highlighted in the map. These sections show no evidence that they would be negatively impacted by the removal of the revetments. Removing these revetments would allow the straightened edges of the brook to renaturalise as well as open new opportunities for restoration in the future.

Priority Large Woody Material

Brookside RRT Implementation plan



Legend
— River network
● LWM opportunities

Author: Abigail Gunson
Project: Brookside Climate Action
Date: 09/07/2025
Coordinate System: British National Grid
Scale: 1:3,500

Some or all of the following statements apply: Contains public sector information licensed under the Open Government Licence v3.0. Contains Ordnance Survey data © Crown copyright and database right 2019; © Environment Agency copyright and/or database right 2019. All rights reserved; © Natural England. Copyright and database rights 2019. Contains, or is derived from, information supplied by Ordnance Survey and Rural Payments Agency. © Crown copyright and database right 2019. Ordnance Survey Licence number: 100022021.

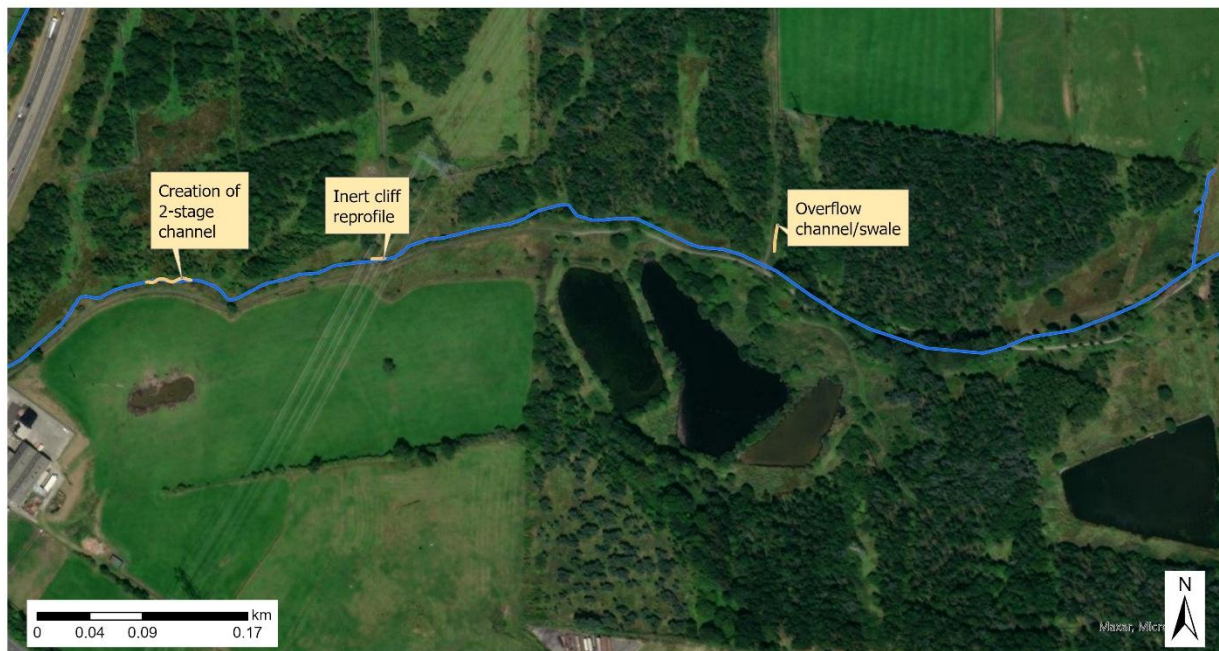
Figure 41 Suggested locations for Large woody material

Large woody material will be essential to introduce variety and texture to the channel. In areas where revetments would not be able to be removed, forcing the water to flow through woody material will slow down the flow significantly and allow the channel to become as natural as possible even with laid stone banks. The material is a reliable method to support other methods mentioned in this study including the creation of the two-stage channel or encouraging water to spill into the created wetlands.

The addition of woody material will also provide a more diverse river habitat that will support healthy invertebrate and fish communities.

Priority Channel Works

Brookside RRT Implementation plan



Legend
 — River network
 — Channel works

Author: Abigail Gunson
 Project: Brookside Climate Action
 Date: 09/07/2025
 Coordinate System: British National Grid
 Scale: 1:3,500

Some or all of the following statements apply: Contains public sector information licensed under the Open Government Licence v3.0. Contains Ordnance Survey data © Crown copyright and database right 2019; © Environment Agency copyright and/or database right 2019. All rights reserved; © Natural England. Copyright and database rights 2019. Contains, or is derived from, information supplied by Ordnance Survey and Rural Payments Agency. © Crown copyright and database right 2019. Ordnance Survey Licence number: 100022021.

Figure 42 Suggested channel works

There are several suggested channel works that would likely improve the capacity of the brook to hold water, especially during and after high flow events.

The 2-stage channel – roughly 35m of the channel is suitable for 2-stage channel creation. The reprofiling of the channel will only be able to occur on the left-hand bank as the footpath is on the right-hand bank. This is a more suitable option here than a wetland, as the land adjacent to the brook is already inundated with water semi-permanently, which wouldn't justify the creation of a new wetland.

The simple floodplain will be the next interception point for the filtered water after wetland 1 and will encourage natural recovery.



Figure 43 partially formed 2-stage channel



Figure 44 Suggested dimensions for cliff reprofiling

Cliff reprofile – A steeply eroded section of the left-hand bank could be reprofiled to provide a more accessible crossing for horse riders as well as mitigate for any future collapse.

10m of the bank upstream of the footbridge would be enough space to reprofile and create an appropriately sized crossing. The figure roughly splits the 10m into different characteristics,

the first 2m of the bank should remain as it is since there is a fence just upstream. The 5m in the middle can be fully reprofiled to a shallow gradient and gradually increase back to the footbridge for the last 3m. Vegetation of the bank with seed matting and willow staking can be used after the works to secure the new profile and ensure no further erosion takes place.

Overflow channel/swale – In conjunction with the new wetland 3 (figure 36), a short length of a new overflow channel would help in establishing a flow path that would redirect water flowing from the top of Stanhill to the wetland rather than the bridge. Encouraging the water this way will reduce the flow of water over the bridge, which has previously been one of the causes for its erosion.

Priority Erosion Mitigation

Brookside RRT Implementation plan



Legend	
	River network
	Erosion mitigation

Author: Abigail Gunson
Project: Brookside Climate Action
Date: 09/07/2025
Coordinate System: British National Grid
Scale: 1:3,500

Some or all of the following statements apply: Contains public sector information licensed under the Open Government Licence v3.0. Contains Ordnance Survey data © Crown copyright and database right 2019; © Environment Agency copyright and/or database right 2019. All rights reserved; © Natural England. Copyright and database rights 2019. Contains, or is derived from, information supplied by Ordnance Survey and Rural Payments Agency. © Crown copyright and database right 2019. Ordnance Survey Licence number: 100022021.

Figure 45 Locations where active erosion would most likely impede public footpath

The marked areas are those identified to be locations where the right-hand bank of the brook has eroded or is actively eroding within 5m of the public footpath. The interventions suggested will mitigate any future erosion by stabilising the bank edges. It should be noted that large sections of the banks are colonised by Himalayan balsam, which will increase the risk of erosion due to their short roots which reduces the ability to hold the bank together during high flow events.

Additional Considerations

It should be noted that the design of the suggested treatment wetlands would be influenced by the results of the contamination study commissioned for Brookside. The placements and designs of other interventions such as bunds, LWM and the ponds would need further consideration to ensure it is in the optimal state.

Summary table

Intervention	Estimated cost range	notes
Wetland creation		Predicted costings based on previous projects of similar ecological value. True cost will differ. Depends on size and complexity of wetland.
Wetland 1	£132k	
Wetland 2	£14k	
Wetland 3	£18k	
Wetland 4	£68k	
Horseshoe bunds	£80k	
Ponds and retainers	£22k	
Revetment removal	£3-5k	Estimation from EA (2015)
Natural recovery	-	-
Leaky Woody material	£13-16k	Depending on number
Channel works		
2-stage channel	£7k	
Cliff reprofile	£7k	
Overflow channel	£7k	
Erosion mitigation	£12.5k	

References

Cost estimation for managed realignment – summary of evidence, Environment Agency (2015)

https://assets.publishing.service.gov.uk/media/6034ee49d3bf7f265dbbe305/Cost_estimation_for_managed_realignment.pdf

Västilä, K., Väisänen, S., Koskiaho, J., Lehtoranta, V., Karttunen, K., Kuussaari, M., Järvelä, J. and Koikkalainen, K. (2021). Agricultural Water Management Using Two-Stage Channels: Performance and Policy Recommendations Based on Northern European Experiences. *Sustainability*, 13(16), p.9349. doi:<https://doi.org/10.3390/su13169349>.

Wild Trout Trust publications (2025) Chalkstream habitat manual <https://www.wildtrout.org/content/wtt-publications>

[Wetlands as nature-based solutions for water management in different environments - ScienceDirect](#)