River Dove NFM Project

Summary report – June 2026



Catchment Based Approach

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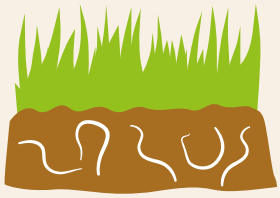
PROJECT KEY STATISTICS



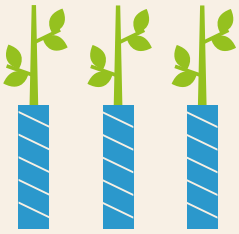
7,647m³
of effective water storage during flood events



27 ha
of floodplain reconnected with the river



325ha
of soils in better management



1km
of new hedgerow established



15
landowners engaged



1.2km
of buffer strip created around watercourses

PROJECT DELIVERY PARTNERS

Yorkshire Wildlife Trust

Yorkshire Derwent Catchment Partnership

Environment Agency

Catchment Sensitive Farming
Working together for a healthy environment

NORTH YORKSHIRE COUNCIL

North York Moors National Park

Yorkshire Regional Flood & Coastal Committee

YorkshireWater

EXECUTIVE SUMMARY

The River Dove Natural Flood Management Project (NFM) was delivered between 2024 and 2026, led by the Yorkshire Wildlife Trust and the Environment Agency. The project was developed in response to repeated flooding in Kirkby Mills and Keldholme, including major events in 2000 and during Storm Darragh in December 2024. The objective was to reduce flood risk by restoring natural and enhancing natural processes across the catchment, increasing water storage, improving soil health, and delivering wider environmental benefits.

The project secured £306,000 of flood risk funding through Flood Defence Grant in Aid and Local Levy contributions and adopted a catchment-scale approach combining floodplain restoration, water attenuation features, soil management improvements, hedgerow creation, buffer strips, and leaky barriers. Engagement with 18 farm holdings and 15 landowners enabled the identification and delivery of measures tailored to local conditions.

A significant achievement for the project has been the restoration of floodplain connectivity along the River Dove. Three major floodplain reconnection schemes at Grouse Hall and adjacent sites were completed, resulting in 27 hectares of floodplain being reconnected to the river. Hydraulic modelling demonstrated substantial increases in flood storage and delays in flood peak propagation. During Storm Darragh, the Grouse Hall site alone is estimated to have accommodated approximately 8,000-9,000m³ of floodwater, providing clear evidence that the restored floodplain was functioning as intended.

Across the wider catchment, the project delivered a broad suite of NFM measures, including 22 attenuation ponds and scrapes, approximately 1 km of new hedgerow planting, 1.2 km of riparian buffer strips, 20 leaky barriers, and a soil health programme covering 325 hectares of farmland. These interventions were designed not only to reduce runoff and slow the flow of water but also to enhance biodiversity, water quality, carbon sequestration, and climate resilience.

The project achieved an estimated effective flood storage volume of 7,647m³. While this fell short of the original target of approximately 11,000m³ due to site constraints, landowner issues, hydrogeological risks, and the inability to deliver the proposed Ravenswick floodplain reconnection, the scheme remains economically viable and provides positive value for money. Revised estimates suggest the lowest likely flood risk benefits of approximately £335,000 against total project costs of £306,000, while wider environmental and social benefits, including habitat creation, carbon storage, improved soil health, and enhanced community confidence, are likely to increase the overall value substantially.

The project has demonstrated that catchment-scale Natural Flood Management can deliver meaningful flood risk reduction while generating significant environmental gains. It has strengthened partnerships between landowners, conservation organisations, local authorities, and flood risk management authorities, and has created a platform for continued investment in natural flood management across the Yorkshire Derwent catchment. Lessons learned from the project are already informing further work in the neighbouring River Seven catchment and future NFM programmes across the region.

1. INTRODUCTION

1.1 PROJECT BACKGROUND

At the end of the last ice age, ~10,000 years ago, trees covered almost all of the North York Moors (1436km^2). By the end of WWII cover was down to around 13%. With this extensive loss of tree cover, rainfall interception, water uptake and landscape roughness has reduced significantly.

Agricultural and other land uses have increased land drainage, compacted soil and reduced widespread recovery of vegetation cover. Around 73km of new drainage connections were identified within the River Dove catchment since 1950's. Housing and development pressures, and increased run-off from urban settlements such as Kirkbymoorside, has added to this issue and growth is set to continue.

The volume and speed of water reaching downstream locations is likely to be much increased over natural conditions. This also means that there is a large potential to reverse some of this impact.

In recent events, Kirkby Mills and Keldholme have been flooded a number of times from the River Dove directly and the associated blinding of drainage infrastructure (highways, surface water and sewer). The largest recent event was in 2000 when 6 properties were flooded in Keldholme and 21 in Kirkby Mills along with 6 industrial units. A similar number flooded again in December 2024 during Storm Darragh. Since 2000 the risk has not been addressed at its source and properties, curtilages and access roads remain at risk.



Kirkby Mills, 2000

Previous residential owners in this area have provided commentary and photographs from previous flood events report the access road to Kirby Mills being flooded 750mm deep during the 2000 event.

The 2000 and 2024 flooding occurred following rainfall events that have been assessed as statistically likely to occur every 20 to 30 years on average. Damages resulting from these events is estimated to run to several hundreds of thousands of pounds.

With the anticipated impacts of climate change, peak river flows are likely to increase, and heavy rainfall events anticipated to become more intense and more frequent. The UK Climate Projections 2018 data points to an increase in peak rainfall intensity of between 17-35% by the 2040-2059 epoch with around a 20-23% increase in peak river flows.

Some improvements have been made in recent decades since the largest event in 2000. North Yorkshire Council (NYC) have been able to deliver some Property Level Protection (PLP) and brought about some land management change on the land immediately above the Town.

However, the nature of these smaller more dispersed communities in upland locations often means that there are too few benefits to justify more traditional and costly flood defences such as banks, walls and reservoirs. The reservoir constructed as part of the Pickering scheme for example cost c. £5m. Natural Flood Management (NFM) can be delivered at a low-cost relative to these measures and is in keeping with the CFMP intent and the Environment Agency's (EA) recently updated FCERM Strategy.

Kirkbymoorside Town Council themselves commissioned a Natural Flood Management Opportunities report in 2021: JBA Consulting Report Template 2015 (kirkbymoorsidetowncouncil.gov.uk). This report identified a number of measures which could be considered to slow the flow and store water in the catchment.

Kirkbymoorside, Kirkby Mills and Keldholme fall in 'The Uplands' sub area in the Derwent Catchment Flood Management Plan (CFMP) 2009, which states:

'we will seek opportunities to reduce run off and store water within the sub area. Upland habitats can be improved to help reduce runoff and manage flood risks as part of a catchment wide approach to flood risk management that exploits natural processes wherever possible. We will seek opportunities to restore the natural flood storage by allowing the river to reconnect with the floodplain to slow the passage of water out of the area.'

Alongside the long-term strategy for restoring natural process and slowing the passage of water out of the uplands, the EA's e:Mission commitments on achieving net zero carbon by 2030 requires a reduction and offsetting of carbon emissions in its schemes. This project is inherently low carbon in delivery and will provide carbon capture throughout its lifetime.

The growing NFM evidence base and expertise within the Derwent Catchment Partnership, of which YWT are the hosts, means that there is increasing confidence in effective NFM delivery.

After a proportionate assessment, there were at least £479,052 of present value benefits identified from delivering an NFM project. This is as a result of reduced flood risk and environmental enhancements through areas of habitat and lengths of the river restored, created or enhanced.

NFM has the potential to deliver both volume and peak level reductions to lessen the impacts of climate change as well adding to carbon sequestration efforts. The added environmental benefits support the government's 25-year plan for Environmental Net Gain, as well as adding amenity value to local residents and visitors alike. The 25-year plan objectives include improving our approach to soil management, increasing woodland cover to 12% and reducing the risk from environmental hazards. This scheme directly supports these outcomes.

Much of the River Dove catchment sits within the North York Moors National Park as well as the Special Protection Area (SPA), Special Area of Conservation (SAC) and Site of Specific Scientific Interest (SSSI). An NFM style project is thought to be the right approach to ensure flood risk measures blend into the landscape and management objectives for these designations, our partners and residents alike.

As a result of the JBA report, the Environment Agency and the Yorkshire Wildlife Trust developed a 'Collaborative Agreement' to implement an NFM Project in conjunction with other members of the Derwent Catchment Partnership.

Subsequent engagement identified several local landowners who expressed a willingness to explore work such as floodplain reconnection and wetland habitat improvements.

This ambitious but deliverable project has supported the community in their efforts to reduce their flood risk and to provide a more sustainable future in the face of a changing climate.

1.2 PROJECT APPRAISAL AND DESIGN

To appraise the benefits of NFM, this project was able to use the existing evidence base and appraisal guidance processes to estimate benefits and justify the spend. The appraisal was based on some key assumptions which are proportionate to the scale of investment. The main assumptions are:

- That an NFM project could deliver a 3% reduction to peak flow. A recent national NFM report and other local examples (Pickering, Leeds FAS) suggest NFM projects are producing 4-7% reduction in peak flows. The existing river flow data indicates a greater than 3% difference between the 10 and 3.33% AEP on the River Dove therefore suggesting that properties would move across a risk band.

- NFM would only provide benefit for around 10 years. Whilst some measures such as planting would likely go on and even improve beyond this, other measures such as ponds might require maintenance which isn't guaranteed in the longer term.

- NFM would only benefit at relatively more frequent return periods, namely the 10% AEP. The EA's review of the last national NFM program suggested that NFM measures get drowned out and become less effective in the higher magnitude, less frequent events.

Using the modelled data from 2019 Vale of Pickering model, flood depths were estimated using the modelled water levels and available LIDAR and previous reports of flooding. These depths were applied to the MCM depth damage calculator to allow for a calculation of direct residential damages.

YWT produced high level figures for the environmental outcomes using the NFM opportunities report that the Town Council had procured through JBA. These figures were put into the Partnership Funding (PF) calculator to understand eligible benefits. This figure was then capped to ensure that the appraisal did not include more than around 20% of total project benefits from environmental outcomes. Total project benefits were estimated at ~£480k.

YWT used previous experience to build an initial cost estimate for project delivery at Strategic Outline Case (SOC) using the JBA report. With Optimism Bias and risk, total costs came to £266k. These calculations lead to a Benefit Cost Ratio of 1.8:1 and a PF score of 165%.

A bid was made to the Yorkshire Regional Flood and Coastal Committee for Local Levy funding to achieve the required PF score greater than 100%. £154k was secured through this bid with the remaining £94k shown to be eligible for traditional Flood Defence Grant in Aid.

An initial SOC had been approved to allow for early engagement and design work which was led by YWT. The EA and YWT entered into a collaborative agreement at this point.

This led to a spreadsheet of measures that had been identified and provisionally agreed with landowners to show that the project can deliver the outcomes at the right scale and cost, including an estimation of storage volume. Using data from Pickering 'Slow the Flow' (Forest Research), 'Leeds FAS Phase 2' and other wider open-source literature it was possible to estimate the average storage volumes to be expected from a variety of NFM interventions.

NFM measures identified mainly included floodplain reconnection, buffer strips, planting, scrapes, attenuation ponds, leaky barriers, large woody debris and soil health work.

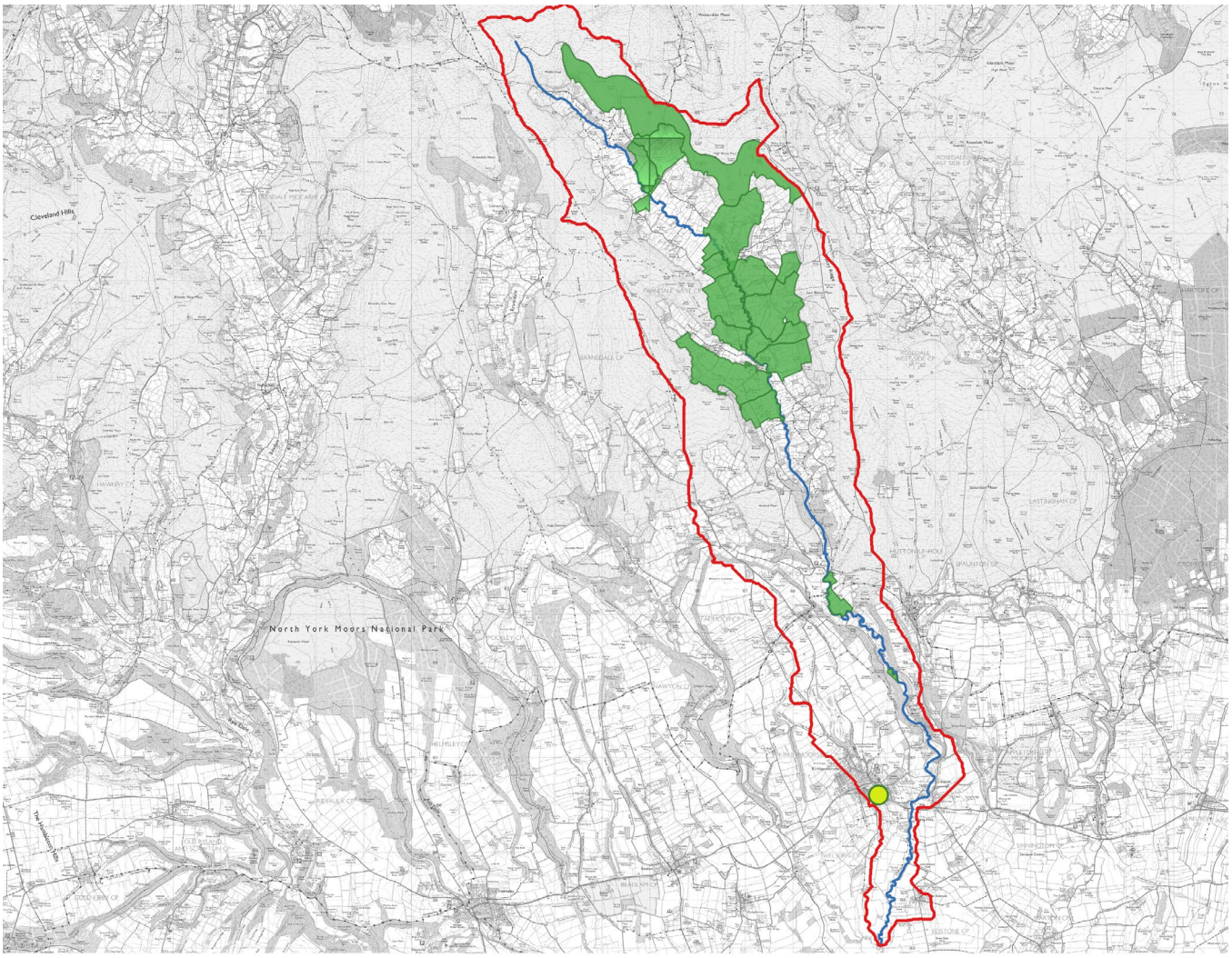
To check costs and understand the scale of measures required to achieve the target benefits, comparisons were made to other NFM projects that had or were delivering at least a 3% peak flow reduction, in terms of storage volume per Km^2 of catchment. Pickering slow the flow, Leeds FAS Phase 2 and Eddleston Water were reviewed for this. An estimation of ~$180m^3/Km^2$ was produced from this review.

A further check was done using the flow gauge data in Kirkby Mills to work out flow past a point in a 12-hour event using peak flows for the 10 and 3.33% AEP.

By making these comparisons and checks it was possible to estimate the minimum storage volume required, suggesting that ~$11,000m^3$ of storage would be required in the $59Km^2$ Dove catchment as a minimum.

A Full Business Case was then produced on the basis that the measures provisionally agreed with landowners matched the storage need to realise the target benefits.

2.0 PROJECT DELIVERY



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Yorkshire Derwent Catchment Partnership

River Dove NFM Project:

River Dove Project Area Kirkbymoorside River Dove

Areas of engagement

2.1 EARLY DELIVERY 2024

After Full business case approval in April 2024 for a £266k total project value, delivery of measures was able to fully commence. The consultant 'Envirocentre' and the River Restoration Centre were engaged and helped to progress detailed design work for 2 larger floodplain reconnection opportunities at two key sites along the River Dove; at Grouse Hall and Ravenswick. Landowner engagement in the upper catchment also continued positively with around 18 farms and sites visited. The potential measures identified were close to the minimum target for flood storage (at least 11,000m^3) and environmental outcomes; measures which were tailored to the needs and situation of each farm.







Images 1 – 3 Examples of offline water storage in Farndale, Environment Agency staff volunteering day to address surface runoff issues above Kirkbymoorside.

2.2 GROUSE HALL: FLOODPLAIN RECONNECTION

Through consultation with the landowner from the outset of the project, the site, which at the time was in underperforming arable cultivation, was identified as a potential location for arable reversion to pasture and reconnection of the latent floodplain areas with the river.

2.3 BASELINE CONDITION FLOODING

Establishing current interaction between the floodplain and the river during 1 in 10 and 1 in 30-year rainfall events is crucial to understanding how to approach enhancing the site to return favourable storage volumes and reductions in the peak of the flood event.

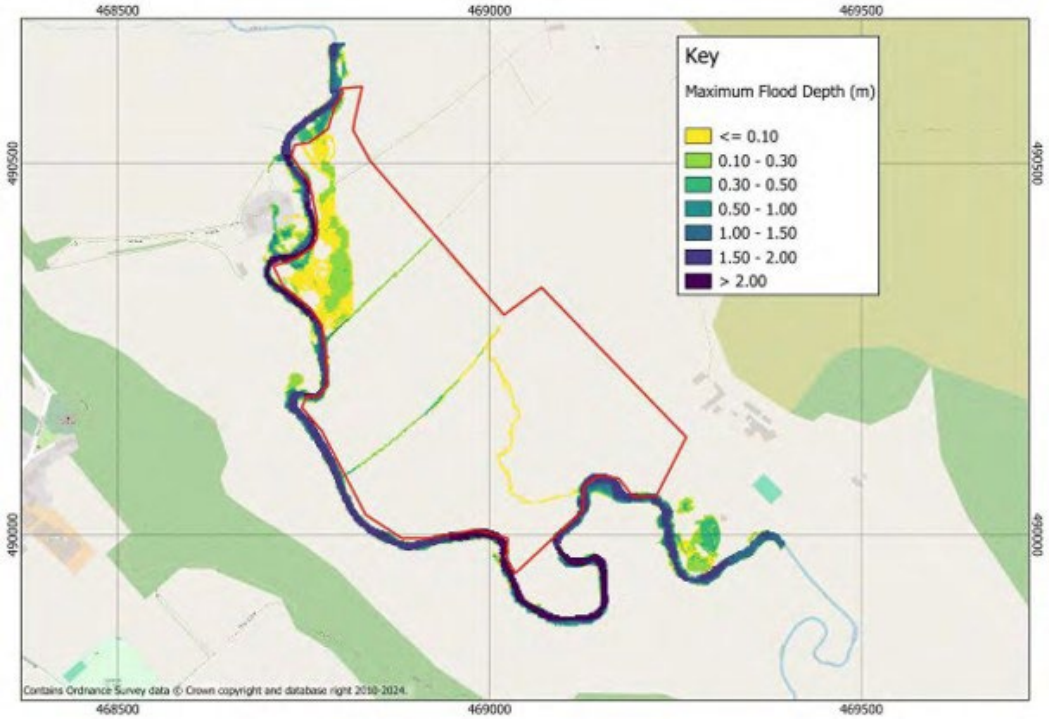


Figure 1 – Baseline flooding at 1 in 10-year event. At the 1 in 10 scale events, some floodplain activation occurs, however the floodwaters re-enter the river approximately 200m downstream with a shallow flow path no more than 30cm deep.

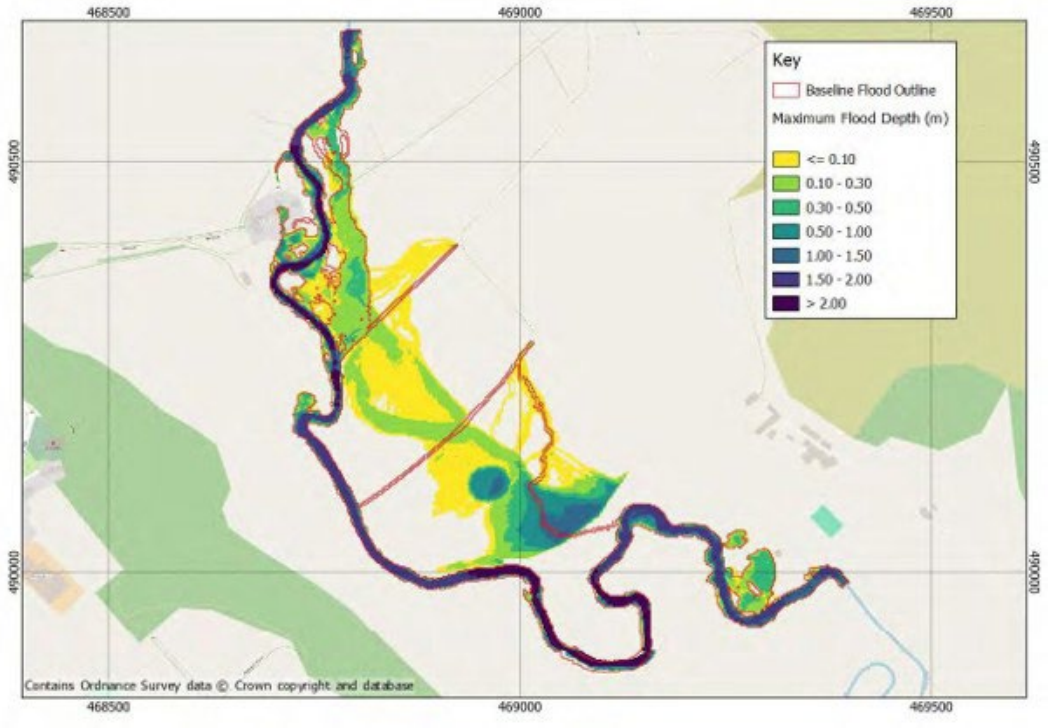


Figure 2. Baseline flooding post intervention at 1 in 10-year event.

The aim of the final design is to promote floodwaters to continue downstream on the floodplain, to accentuate the storage volumes and reductions on the peak flow, relandscaping the Southern end of the site using excavated materials from within the floodplain was chosen as a necessary feature.

As can be seen from the modelling, the site post intervention shows floodwaters spreading across the floodplain pooling at greater depth before re-entering the river at the Southwestern corner of the site. The abrupt stop in the flood water is showing the reprofiled Southern end of the site acting as a block to stop floodwaters "cutting the corner" of the river re-entering the river sooner than anticipated.

At the 1 in 10-year event, this option has a floodplain volume of 14,600 m³ compared to 3,900 m³ for the baseline peak flood, an increase of 10,700 m³. And has 7,000m³ retained on the floodplain, compared with 1,100 m³ in the baseline model an increase of 5,900m³.

At the 1 in 30-year event, the floodplain has a volume of 22,200m³ compared to 7,200 m³ for the baseline peak flood, an increase of 15,000 m³. And has 8,800 m³ retained on the floodplain, compared with 1,600 m³ in the baseline scenario, an increase of 7,200 m³.

The outflow hydrographs simulated at the downstream extents of the model are compared in Figure 3. These show a delay in the rising arm of the hydrograph, of up to 20-30 minutes, and a small reduction in the predicted flood peak.

The outflow hydrographs simulated at the downstream extents of the model are compared in Figure 4. These show a delay in the rising arm of the hydrograph, of up to 15-20 minutes, and a more pronounced reduction in the predicted flood peak.

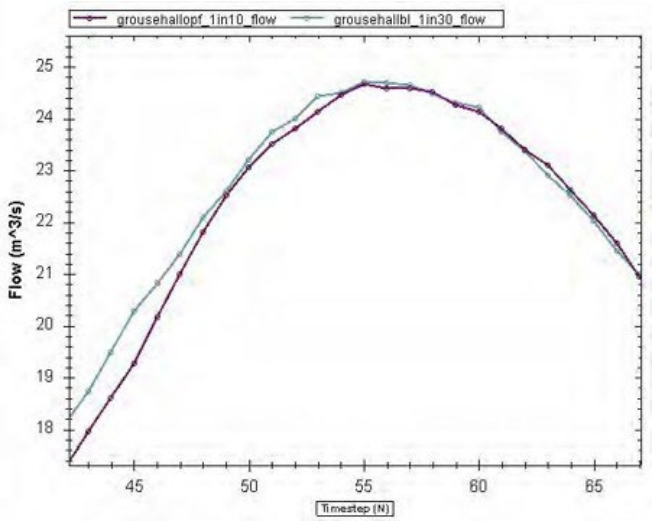


Figure 3. Hydrograph comparison downstream of the study area for 1 in 10-year event.

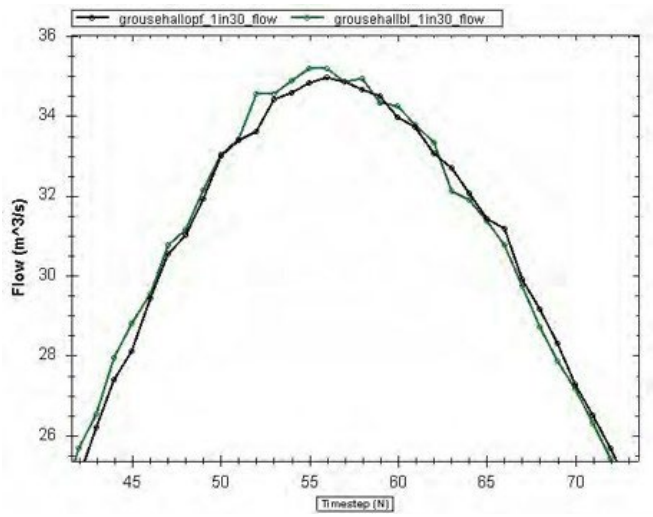


Figure 4. Hydrograph comparison downstream of the study area for 1 in 30-year event.

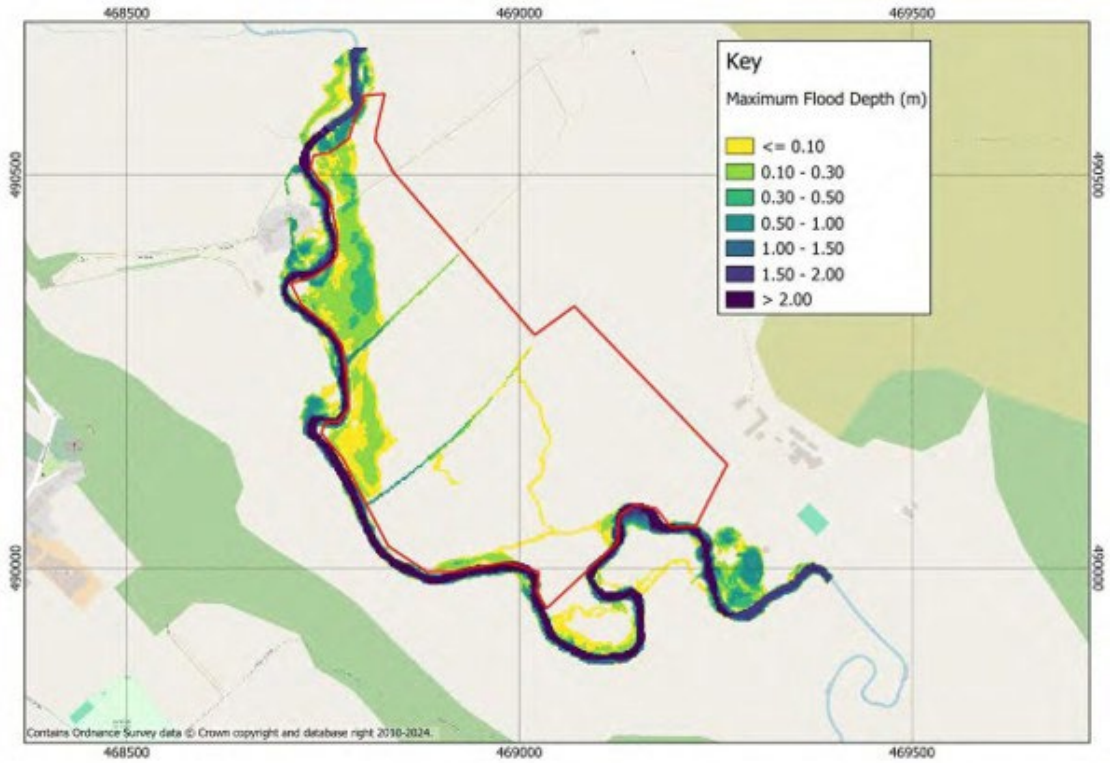


Figure 5. Baseline at 1 in 30-year event.

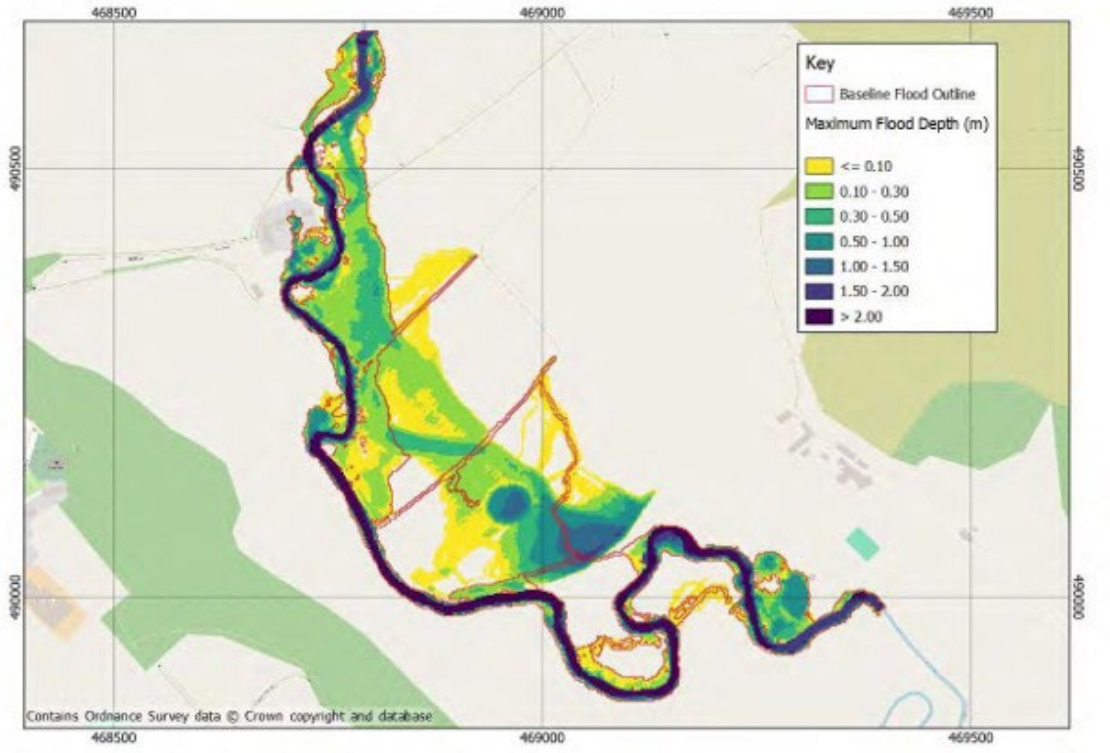


Figure 6. Baseline flooding post intervention at 1 in 30-year event.

2.4 FINAL DETAILED DESIGN

Based on the findings of the feasibility study the final detailed design was produced and able to proceed to delivery.

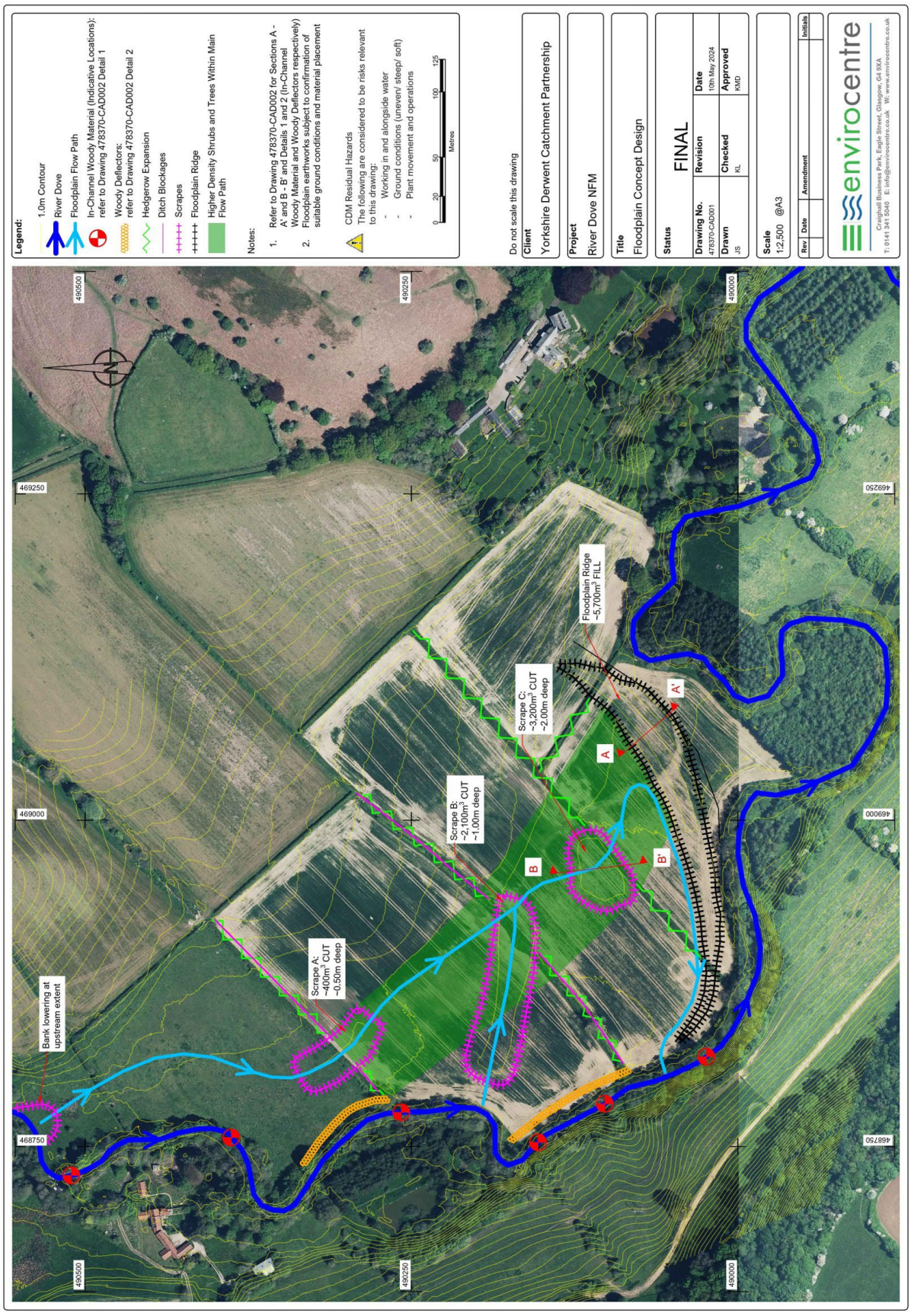


Figure 7. Final detailed design of Grouse Hall.

2.5 DELIVERY AND COMPLETION

Working in partnership with the North York Moors National Park, Farming in Protected Landscapes team, the project was able to match fund to make delivery of the work possible whilst maintaining sufficient budget to deliver on the project's wider outcomes in the catchment.

Work began in September 2024 with construction of site access and welfare facilities and continued through September with the completion of all groundworks by the end of the month.

Archaeological oversight was in place during the excavations, with some regionally significant findings made, a separate report on this is available from the Archaeological Data Service at https://archaeologydataservice.ac.uk/ search term Grouse Hall. Carbon dating is being explored with funding support from Historic England to ensure the discovery can be appropriately assessed and logged with York Museum. It is likely that these finds co-incide with the line of a paleo-channel which perhaps underlines why the land was already lying wetter than its surroundings.



Image 4. Grouse Hall site September 2023, before work began looking upstream.



Image 5. Grouse Hall site immediately after completion of groundwork in September 2024 looking downstream.



Image 6. Grouse Hall site July 2026, looking upstream.

2.6 STORM DARRAGH DECEMBER 2024

During storm Darragh in December 2024. It is estimated that around 8-9000m³ of water was active on the floodplain following Storm Darragh that otherwise would not have been able to access this land.



Image 7. The floodplain active during storm Darragh.



Image 8. Floodwater gathering at the Southern end of the site during storm Darragh 2024.

Following the storm numerous gravel banks appeared in the channel providing a much more dynamic channel habitat and potential fish spawning ground. Reports of wading birds and their chicks using the new scrapes arrived quickly after completion, so it appears there are significant environmental outcomes here now too.





Images 9 & 10. Left: Gravel banks forming due to in channel woody materials. Right: Seasonally wet areas forming, ideal for wading birds, winter 2026.

Some repair work had to be completed at the site as the grass cover had not re-established before the storm arrived and some wash out occurred. These additional costs, as well as the unforeseen archaeology work, and other delays to the programme led to the submission of a Business Case Update Report and the request for an additional £40k GiA taking the total grant funding to £306k.

Storm Darragh rainfall was assessed by hydrologists at the Environment Agency as up to 80mm in around 24 hours and having a return period of up to a 1 in 25-year frequency (4% Annual Exceedance Probability). This led to flooding of several properties in Kirkby Mills and Keldholme.

This is despite the impact of the early measures and Grouse Hall site being largely complete. The project team asked the EA hydrologist to try and compare the Darragh event to 2000 event which was had a similar rainfall total to see whether the initial NFM work had a noticeable impact. The feedback was that the data is inconclusive. There are too many other variables to compare each event, such as antecedent conditions, baseflow, vegetation cover, storm track, rainfall intensity that could account for some of the differences in the observed hydrology and flood impacts before being able to say that NFM measures alone had reduced the risk.

The peak river level in 2024 was the highest on record but only by a very small margin. Rainfall was less intense though and antecedent flow was around half the 2000 conditions. However, these comparisons are largely irrelevant once the river is bank full and is overtopping into the floodplain. A more relevant measure might be how long overtopping occurred for and how much volume managed to access the floodplain.

The floodplain volume is hard to quantify but in terms of overtopping duration, the analysis suggests this happened for around 16.5 hours in the 2024 event compared to only 5.5 hours in the 2000. 'Storm depth' was slightly higher in 2024 too, meaning a little more rainfall contributing to the peak flow. Despite this, there were reports from some of the affected residents that levels of internal flooding weren't quite as high as the 2000 event. The substantial volume of water at Grouse Hall certainly demonstrates there must have been some betterment, although the washout in part of the bank may have reduced its efficacy.

2.7 ADDITIONAL FLOODPLAIN RECONNECTIONS

The Ravenswick site proved more problematic. The underground geology of the site indicated that any excavations could be a risk both in terms of health and safety but also the potential to impact the hydrogeology through pollution, sediment and altering the sub-surface flows. BGS boreholes records were searched to understand the cave systems below 'Dowson's Field' but none were available. It was agreed that the project did not have the resources to procure geophysical investigations within budget.

Subsequent enquiries were made with the York Caving Club who were extremely helpful in providing several reports and videos of their findings and surveys. However, due to a loss of access at the site, their records weren't complete. Through discussions with the land manager and YCC access was re-established and YCC are continuing their survey work at the time of writing, and they have advised against substantial lowering of the floodplain across the site without better data, which the project team agreed with.

In addition, the project has been unable to secure an agreement with the landowner at Ravenswick to carry out the work. They had initially indicated they could do the work themselves, but discussions are still ongoing about a way forward that would be acceptable. Any work here needs to manage the sub surface risks. If the landowner is still willing, there may be a compromise option that maximises connectivity of the existing floodplain rather than lowering new areas. The project team intend to continue reaching out to the Estate beyond the project to explore this opportunity.

Due to the topography of the catchment, there is little availability of substantial floodplain habitat, to rectify the loss of flood storage in a location so close to the affected area at Ravenswick. The project used desk study of LiDAR to identify further floodplain reconnection opportunities that were not originally in the scope of the project.

A separate feasibility study was commissioned funded by FiPL with capital work funded by a contribution from Yorkshire Water and the remainder by the project directly. Four sites were modelled, three in the lower catchment and one in Farndale.

Of those sites the Farndale site, was deemed unsuitable due to concerns raised by Natural England on the effects it may have on the SSSI designation of the site, modelling later showed that there would have needed to be substantial groundwork to the site for favourable outcomes, making the site un-economical.

Of the three remaining sites, referred to as Grouse Hall North, Central and South due to proximity to the completed Grouse Hall site. Central was unsuitable due to the level of groundwork required, in both cases the unsuitable sites have sections of the river that are over deepened, a common issue in on many rivers in the UK. This has occurred due to land use change, drainage and increasingly powerful periods of the river being in high flow, scouring out the riverbed.

Grouse Hall North and South proceeded to detailed designs and were completed in spring 2026.

2.8 GROUSE HALL NORTH

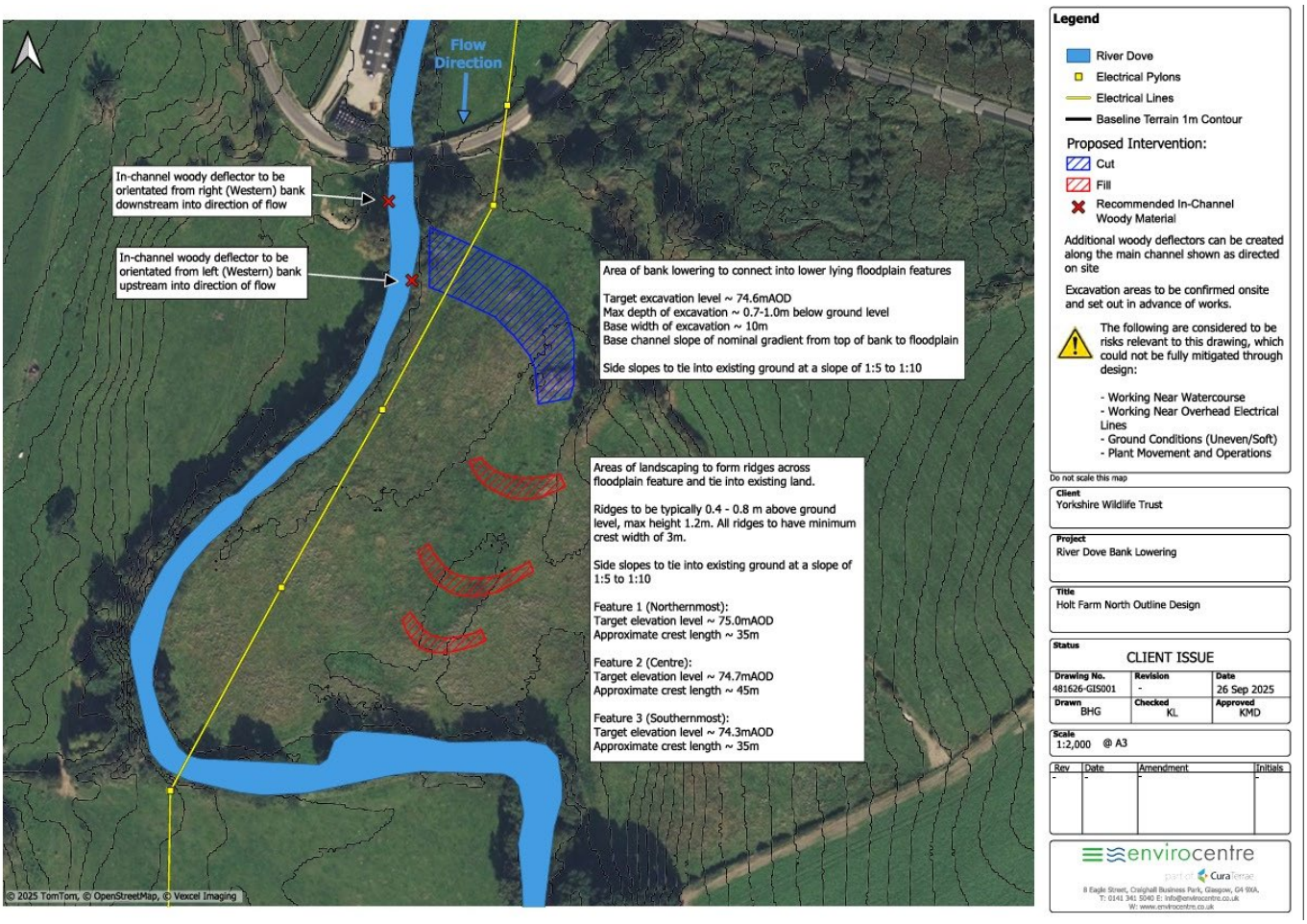


Figure 8. Final detailed design for Grouse Hall North.

Located directly North of the original reconnection site, modelling provided good additional flood storage and a relatively low level of alteration to achieve it.



Image 11. Grouse Hall North Spring 2026 work starting.



Image 12. Grouse Hall North post completion April 2026.

2.9 GROUSE HALL SOUTH

The site required more technical groundwork to realise the benefits and keep floodwaters from re-entering the river, work was completed in May 2026.

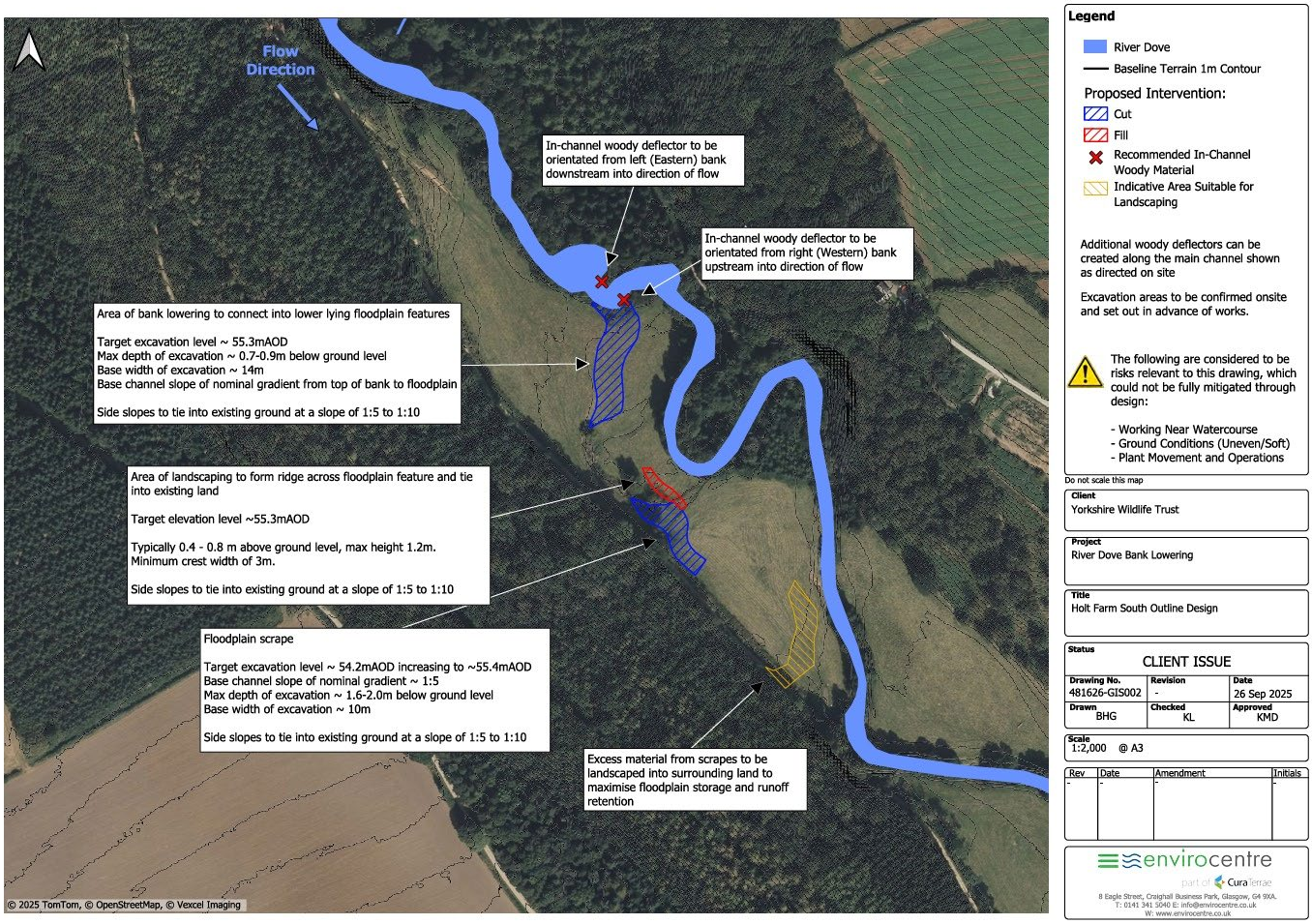


Figure 9. Final detailed design for Grouse Hall South.



Image 13. Grouse Hall South post completion May 2026.

2.10 FLOODPLAIN RECONNECTIONS – CONCLUSIONS

When compared to the number, size and storage capacity of the numerous “farm scale” attenuation measures installed in the upper catchment it was deemed more effective to pursue larger floodplain reconnections.

The project has shown that identifying and undertaking some level of localised modelling, supported by volume estimations based on geographic parameters, targeting the available floodplain storage can deliver effective NFM storage at a useful scale within a limited project timeframe.

Restoring or enhancing floodplain connectivity with the river is a long-term effective and passive way to mitigate flood risk, it is also a process based approach, that is, to restore the natural function and hydrological processes of rivers and their floodplains. Based on data collection and modelling evidence as a justification that the measures are appropriate at specific locations.

The Dove catchment like all catchments is unique, there is a lack of available floodplain throughout the catchment due to the topography and geology. The project has been able to target the majority of floodplain area of significance in the catchment.

As with all NFM projects it is this combined with the smaller scale measures and changes to land management practice that will combine to help reduce flood risk.



Image 14. Grouse Hall Spring 2026.

3.0 UPPER CATCHMENT DELIVERY

3.1 OVERVIEW OF MEASURES AND ENGAGEMENT

The project engaged with 18 farm sites in the upper catchment to carry out walkover surveys throughout 2024, from this several sites presented good opportunities for multiple measures. Work concentrated in the middle of Farndale, following positive engagement with Farndale estate, the first measures began to be installed during late spring 2024.

In 2024 the project sought collaboration with the nearby moorland restoration program delivered by the NYMNP under their “moors to restore” program. Unfortunately, the restoration plans for the area at that time had not progressed to delivery stages, it hoped these plans will come to fruition in the future.

A range of other measures were delivered, focussing on water attenuation scrapes with earthen bunds, fitted with small diameter slow-release pipes, there is a lack of ephemeral water features in the upper catchment, aside from providing flood alleviation benefit, the provision of increased invertebrate habitat and water resource will provide opportunities for a wide range of wildlife. Other measures consisted of buffer strips along the watercourses and leaky timber dams.





Images 15 & 16. Examples of offline storage in the upper catchment.



Image 17. Large offline storage in the upper catchment.

Multiple opportunities for establishing new hedgerows on old field boundaries were delivered, in part funded through the NYMNP strategic boundaries fund and some directly through the project. Totalling approximately 1km of newly established hedgerow by spring 2026 with a remaining several 100m to be planted in autumn 2026.

For all work that was delivered throughout the project, landowners were asked to sign up to informal maintenance agreements which covered a period of a minimum of five years, and where possible encouraged to seek funding to do so via ELMS schemes. Agreements allow for YWT staff to access measures during and after completion to monitor effectiveness and quality of work.

As with many NFM projects, there has been a large degree of good will on the part of project delivery staff and the landowners themselves, that they see the benefits for their land and in the wider context.





Images 18 & 19. Examples of hedgerow creation in the upper catchment.

3.2 SOIL HEALTH

Poor soil health and compaction is known to lead to increased levels of surface water run-off, working with Farndale Estate and tenant farmers, a soil health event was held at Farndale village hall in summer 2025. The event was well attended and led by a leading soil health expert.



Image 20. Soil health workshop in Farndale.

Following on from this event, some initial soil testing was carried out which showed compaction is present in the catchment. Farndale Estate agreed to purchase soil aeration equipment, which is to be free at the point of use to the tenants of the estate. This led to a plan of soil aeration over a period of 3 years on around 325Ha of farmland which has been agreed with the relevant farmers.

Farndale Estate are best placed to be responsible for the owning, storing, maintenance and insurance of the equipment which the project could not easily arrange directly. It can also act as a central place for tenants to use the equipment in future if the interest grows.

By the end of the project Farndale Estate had secured the aerator, a first pass of the majority of the land mapped for treatment has been undertaken.

Improving soil health and structure is a long-term vision for the project and one shared by the estate, it is hoped that beyond the lifespan of the project that future workshops and farmer knowledge sharing will lead to increased uptake of the practice. This offers the potential for improved grass yields and reduced winter housing costs for farmers whilst delivering significant accumulative reductions in water entering watercourses during peak flow events. It should also increase drought resilience and potentially lead to a reduction in fertiliser use and therefore improved water quality in the longer term as well.

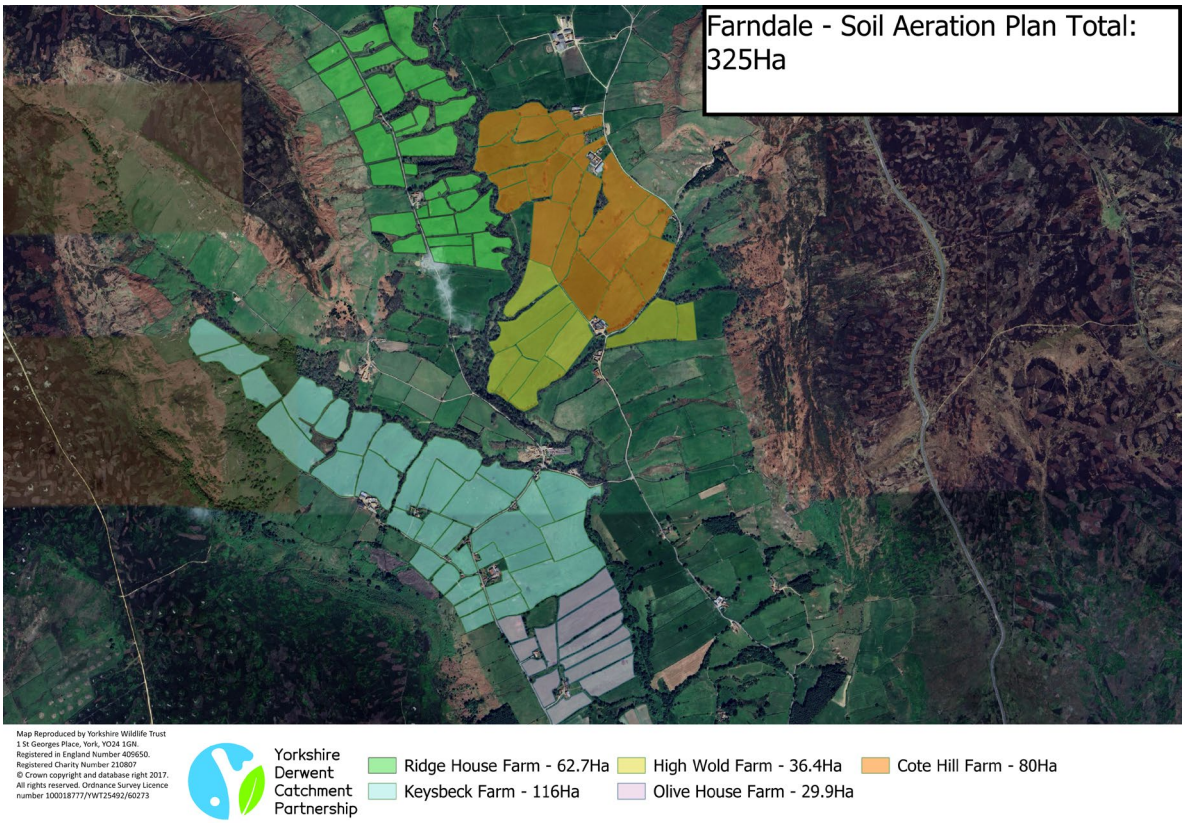


Figure 10. Land parcels to undertake soil aeration treatment in Farndale.



Image 21. First trials of soil aerator in Farndale.

3.3 PROJECT COMPLETION

In July 2026 there remains some work directly above Kirkbymoorside to address surface run-off issues at manor Vale, due for completion by August 2026. There are also three offline storage scrapes and 150m of hedgerow creation in the upper catchment to complete. Soil aeration has continued in late spring 2026 on approximately 100ha so far. Better soil management could become common practice within the farming community in Farndale, with help from further organised events hosted by FIPL.

YWT and the YDCP team have on going run-off and fine sediment reduction programs running for a further three years which includes the Dove catchment, some work has already been completed in 2026, which will complement the Dove NFM work, NYMNP have included the Dove catchment in their Grubs Up! Project which will also compliment the Dove NFM project. YWT intend to continue to engage and work in the area utilising landowner engagement funding and to monitor the effectiveness of measures installed.

YDCP have secured initial funding for a three year NFM / floodplain restoration project on the adjacent River Seven catchment, built of the back of the success of the Dove Project and taking learnings forward.

4.0 CONCLUSIONS AND LEARNINGS

NFM Measure	Quantity	Estimated effective storage per unit	Total effective storage (m^3)
Soil health/aeration	325 Ha	10m^3 / Ha	3,250
Floodplain reconnections	12,650 m^3 (@10% AEP)	0.24 m^3 / m^3	3,036
Attenuation ponds/scrapes	22	Variable – 10-100m^3 per scrape	1,265
Tree/hedgerow planting	1.1km x 3m hedge + 1 Ha trees	55m^3/Ha	73.15
Buffer strips	1km x 3m	4m^3/Ha	16.5
Leaky barriers/dams	20	0.33m^3	6.6
Total			**7,647.25**

The total effective storage volume delivered by the project was estimated at 7,647m^3. A breakdown of the effective storage estimates by measure type is provided above. The storage volumes per unit figures were based on a mixture of available literature at the time of writing the business case and the Environment Agency's NFM Research report Environment Agency external corporate report template that was released during the later stages of the project. The latter report considers the 'effective storage' of measures, rather than design values. These are national averages given the variables that occur by catchment and by flood event. The floodplain reconnection figures were matched to the EA's report as this represented the largest share of storage. The other measures were a mix based on judgement and the numbers used at project inception when the project budget and assumptions were set.

This is 3,353m^3 short of the target which is roughly 30%. Therefore, as a crude assessment of the reduction in benefits, the estimate at Full Business Case of £479,000 of benefit has been reduced by 30% as well leading to a potential new benefit figure of roughly £335,300. The total flood risk Grant in Aid and Local Levy spend was £306,000 so the project remains cost beneficial regardless in terms of flood risk investment. Given the very conservative assessment of benefits, there is low risk in the eventual economic case from this reduction in the final storage volume achieved.

Environmental benefits delivered were also in excess of the 9 Ha target and 5km of watercourse and these benefits were capped in the economic appraisal at inception so economic score would increase significantly again. Additional investment from 'FIPL' for example has unlocked these wider environmental benefits and a more precise economic assessment of those overall project costs and benefits has not been undertaken.

Benefits such as carbon sequestration from the planting, which achieved at least the minimum 368 trees required to achieve net zero, will have a positive carbon value in monetary terms which also hasn't been included. Other qualitative feedback from the Town Council and those flooded during Storm Darragh in December 2024 suggested there is also a notable intangible benefit from the community perception of action and mental health benefit of this.

The project has also acted as a seed fund which has brought in resource, through YWT time, which has led to new connections, ideas and opportunities that both eNGOs, farmers, landowners, the Town Council and private individuals can all build on and which is likely to continue to deliver outcomes well beyond the 10 year benefit period. For example, knowledge and equipment around soil health, and seeing the various sediment traps, scrapes and attenuation ponds in action could well trigger further installations when others see the benefits of them in terms of agricultural productivity and potential agri-environmental payments.

Despite the shortfall in the target storage volume, this has been a largely successful standalone NFM project in a mid-size catchment delivering multiple benefits, some of which has been realised and tested already. This is another useful case study where CaBA partners, particularly YWT, and the local community and landowners have demonstrated that NFM collaboration can unlock several opportunities in a catchment that have shared benefits stretching far beyond the core objective traditionally associated with flood risk grant funding.

GIS spatial data for the locations of all measures delivered throughout the project are available upon request from the author, please contact **henry.morgan@ywt.org.uk** or **info@ydcp.org.uk.**

Several learning points have been identified:

- NFM opportunity scoping reports proved useful to provide high level overview of potential areas for engagement, but are constrained by lack of any ground truthing and landowner buy-in.
- Future catchment scale feasibility studies, should focus on modelling entire river reaches for optimum floodplain storage areas, reconnection sites, to better target engagement.
- Over-programming the storage volume target by 20% to account for measures might have helped given some fell away due to unforeseen constraints, lack of agreement.
- Factoring in more time for seasonality in the delivery window might have helped. I.e. ground conditions only suitable for digging ~50% of the year and farmers have seasonal actions e.g. lambing.
- Assess heritage and archaeology earlier on might have helped and factoring in sufficient budget. The measures weren't fully defined at SOC though so it's hard to budget accurately.
- Seeking LPA view on planning permission early on was useful. EA PD rights helped to streamline delivery and save on cost. This is provided land use change isn't occurring i.e. not creating commercial fishery.
- Allowing more risk for weather impacts could have helped. Drought affected planting and floods affected earthworks.
- Hydrogeology was an unknown constraint that was a redline for floodplain excavations and the geophysical data required can be expensive to obtain if not readily available. More risk budget and time for this may have been better.
- Delivery group. Getting all interested experts from within CaBA partnership into a delivery group was essential.
- There were numerous stakeholders with an interest due to the size of a catchment and its location within various designations and landowners. More time for engagement might have been useful upfront, but engagement was iterative on this project and continued throughout, often where a landowner may wish to support the scheme having seen the success of a neighbour. Upfront funding to do more engagement early on might have been difficult to obtain.
- Prioritising measures with the greatest return on investment increased towards the end of the project. Often this was larger scrapes, ponds and floodplain reconnections.

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