

# Cocker Tidal Channel & Cockerham Marsh SSSI Restoration Investigation



## Overall Summary

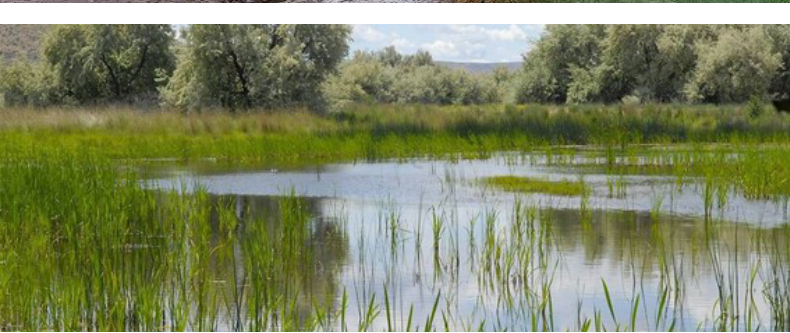
The Cocker Tidal Channel and Cockerham Marsh SSSI Restoration Investigation (part of the Our Future Coast programme) was undertaken by Natural England, Lancashire Wildlife Trust and the Environment Agency.

The study assesses geomorphology, flood risk, land drainage, biodiversity (including decline of the natterjack toad) and opportunities for nature based restoration within the Cocker tidal channel, across the wider Cocker catchment and at Cockerham Marsh SSSI.

### Key Context

- The lower 1.5 km of the River Cocker is an artificially straightened tidal channel (cut in the 1960s).
- Dynamic processes and channel migration at its confluence with Patty's Farm Creek has caused long term saltmarsh erosion near Bank End Farm, raising flood risk concerns.
- Opportunities exist for restoration of the meandering natural Cocker tidal channel, but only if this brings about improved flood risk and biodiversity and does not worsen land drainage.
- Flood risk in the wider Cocker catchment can be affected by high sediment loads from farmland, catchment drainage and blockage of tidal outfall sluices due to siltation, with sediment both off the land and brought in by the sea. These issues potentially have the ability to be improved through nature-based solutions in the catchment.
- Cockerham Marsh SSSI was cut off from tidal influence following flood embankment construction in 1981, leading to habitat degradation and natterjack toad decline. There is potential for restoration of tidal processes to the site to assist in recovery of habitat used by the natterjack.





Natterjack toad

### Key Findings

- **Cocker tidal channel:** re-naturalisation of the meandering natural tidal channel would have limited ecological gain, little effect in reducing saltmarsh erosion and flood risk at Bank End Farm and may worsen flood risk on backing land due to poorer flow through existing tidal outfalls.
- **Cocker catchment:** opportunities exist for improving land drainage and reducing flood risk across land in the wider catchment using nature-based solutions on existing land. Potentially suitable approaches include woody debris, riparian woodland, buffer strips, wetlands, beetle banks, and soil quality improvements.
- **Cockerham Marsh SSSI:** although technically feasible, restoration options are high cost, require considerable flood embankment works to prevent flooding to adjacent land areas, and offer uncertain ecological outcomes, especially for natterjacks.

### Overall Conclusions

- The restoration investigation has produced a strong understanding of geomorphology, ecology and flood risk dynamics.
- Multiple nature-based solution opportunities exist across the Cocker catchment to improve land drainage, reduce sedimentation and support community resilience.
- Although restoration methods are technically feasible at the Cocker tidal channel and Cockerham Marsh SSSI, they generally involve high cost, high uncertainty (including ecological outcomes), or potential adverse impacts, leading to no options being taken forward at present.
- Despite this, the report does provide a robust evidence base to inform restoration opportunities at the Cocker tidal channel and Cockerham Marsh SSSI should future conditions or priorities change.

# Cocker Tidal Channel & Cockerham Marsh SSSI Restoration Investigation

## Task 1 Review: Summary

The Cocker Tidal Channel and Cockerham Marsh SSSI Restoration Investigation, led by Natural England, Lancashire Wildlife Trust and the Environment Agency, forms part of the wider Our Future Coast programme in North West England.

**‘Task 1 - Review’ aims to understand historic and current geomorphological behaviour of the Cocker tidal channel, evaluate flood risk, and identify opportunities to restore natural processes, improve land drainage, and support biodiversity - particularly the recovery of the locally extinct natterjack toad population within Cockerham Marsh Site of Special Scientific Interest (SSSI).**



Straightened Cocker tidal channel

The River Cocker’s lower 1.5 km is a tidal, artificially straightened channel created in the 1960s. Its confluence with the naturally meandering Patty’s Farm Creek forms a dynamic zone where channel migration has historically eroded saltmarsh near Bank End Farm, prompting concerns about flood risk. A 2013 geomorphological appraisal identified saltmarsh retreat due to channel meander incision; Task 1 updates this with new data spanning up to 2024, which shows continued but slightly slower erosion.

The study reviews historic maps (1845–2023), aerial imagery, LiDAR, beach profile transects, and tidal/flood datasets. Historically, saltmarsh across Cockerham Sands has expanded seaward, but Bank End Farm remains a localised erosion hotspot. The tidal channel’s artificially shortened length may force higher energy into the meander near Bank End. Further investigation in Task 2 will seek to identify whether reinstatement of a natural meandering channel (in place of the straight cut channel) could help reduce erosion and alleviate flood risk at this vulnerable location, as well as provide wider biodiversity benefits.



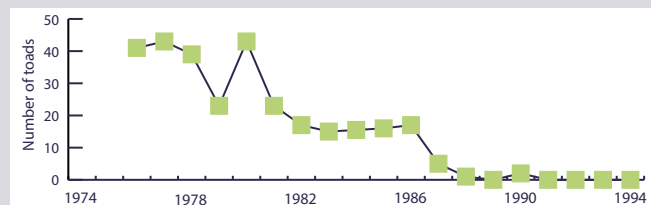
Natural Cocker tidal channel



The area lies within multiple designated sites (SSSI, SPA, SAC, Ramsar) and heavily modified Water Framework Directive waterbodies. Flood mapping indicates large areas of the hinterland are reliant on existing sea defences; without them, widespread tidal inundation would occur. Climate change projections show notable future sea level rise, increasing long term pressure on defences and saltmarsh edges.

Cockerham Marsh SSSI, historically an upper saltmarsh supporting natterjack breeding, was isolated from tidal influence by 1981 land reclamation, leading to habitat degradation and the site's long term 'unfavourable declining' status. No natterjack toads have bred there since 1987. Further investigation in Task 4 will assess potential opportunities to restore tidal exchange, re create suitable breeding pools, and reconnect the SSSI with natural processes.

A site visit in September 2025 confirmed ongoing saltmarsh erosion near Bank End Farm, siltation concerns in the cut channel, and the heavily terrestrial, degraded condition of the SSSI. Engagement with landowners highlighted practical concerns around flood risk, channel re-naturalisation and grazing.



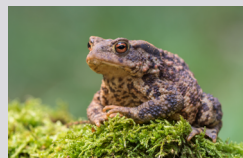
Key opportunities emerging from Task 1 that require investigation include:



**Re-naturalising the historic Cocker channel** or modifying the cut channel to reduce pressures at its confluence with Patty's Farm creek (seaward of Bank End Farm);



**Identifying wider nature based solutions** that could improve flood resilience throughout the catchment; and



**Restoring tidal influence** to Cockerham Marsh SSSI to support natterjack toad recovery.



Task 1 recommends that subsequent tasks of the investigation focus on optioneering channel restoration (Task 2), catchment scale natural flood management (Task 3), and design concepts for restoring tidal processes and habitat quality within the Cockerham Marsh SSSI (Task 4).

All tasks were firmly set within the context of flood risk to surrounding land and property.

# Cocker Tidal Channel & Cockerham Marsh SSSI Restoration Investigation

## Task 2a Optioneering: Summary

2a The Cocker Tidal Channel and Cockerham Marsh SSSI Restoration Investigation, led by Natural England, Lancashire Wildlife Trust and the Environment Agency, forms part of the wider Our Future Coast programme in North West England.

'Task 2a – Optioneering' evaluates restoration options for the Cocker tidal channel, flood risk issues at Bank End Farm, and restoration options for degraded habitat within Cockerham Marsh SSSI, designated for the endangered natterjack toad.



Cocker tidal channel

The optioneering builds on Task 1 findings, new monitoring data and updated climate change guidance. Key drivers for the study include channel instability near Bank End Farm caused by long term saltmarsh erosion at this vulnerable location, legacy of the artificial straightening of the River Cocker in the 1960s, and the isolation of Cockerham Marsh SSSI following 1981 land reclamation.

Long listed options were developed in three themes:



**Managing flood risk at Bank End Farm** – including soft/hard engineering, channel realignment, embankment reinforcement, foreshore recharge, and do nothing.



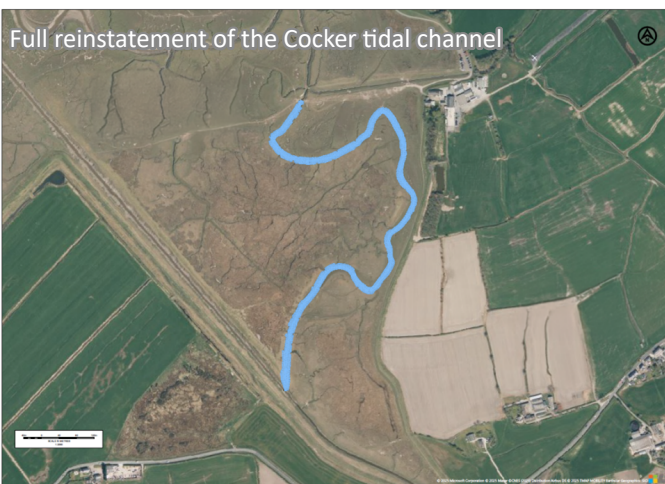
**Re naturalising the Cocker tidal channel** – ranging from do nothing to minor reconnections to full reinstatement of the historic meandering channel.



**Improving Cockerham Marsh SSSI condition** – embankment removal/ breaching/lowering, regulated tidal exchange (RTE), saline treatment concepts, alternative land use, creation of new breeding pools on existing adjacent upper saltmarsh, and do-nothing.



Natterjack toad



Following workshop screening, many engineered or high impact options were removed due to cost, environmental constraints, or conflict with restoration principles. Remaining shortlisted options focused on low intervention or natural process led approaches.

**Bank End Farm** – Modelling shows tidal dynamics dominate erosion patterns, and channel reinstatement would not meaningfully reduce flood risk and could slightly worsen local erosion. Preferred option: **Do nothing**, supplemented by continued monitoring of saltmarsh retreat and channel movement.

**Cocker Tidal Channel** – Partial or full reinstatement offers limited ecological gain because upper saltmarsh is predominantly inundated by over marsh tidal flooding, not by creek connection. Reinstatement also risks increased currents and erosion near Bank End. Preferred option: **Do nothing**, with acceptance that periodic desilting of the 1960s cut will still be required.

**Cockerham Marsh SSSI** – Multiple methods to reintroduce occasional tidal influence were considered. Embankment modifications (removal, breach, notch) are technically workable but expensive due to large setback embankment requirements to ensure neighbouring land is not subsequently affected by tidal waters. Regulated Tidal Exchange (RTE) via pipe and penstock offers lower cost and greater control of inundation frequency - important for natterjack breeding - but requires significant ongoing operational management, desilting and continued habitat maintenance. Creating new pools outside the SSSI offers minor potential benefit but is sensitive to tidal cycles, weather extremes and sedimentation.



Despite technical feasibility, the Project Steering Group concluded that **no restoration option should progress to detailed design** at the present time at Cockerham Marsh SSSI due to high costs, uncertain long term ecological success, land take implications, and the extreme sensitivity of natterjack habitat to tidal and climatic variability. However, the report includes recommendations for future permissions, landownership considerations, and data requirements should restoration options be reconsidered at a later date.

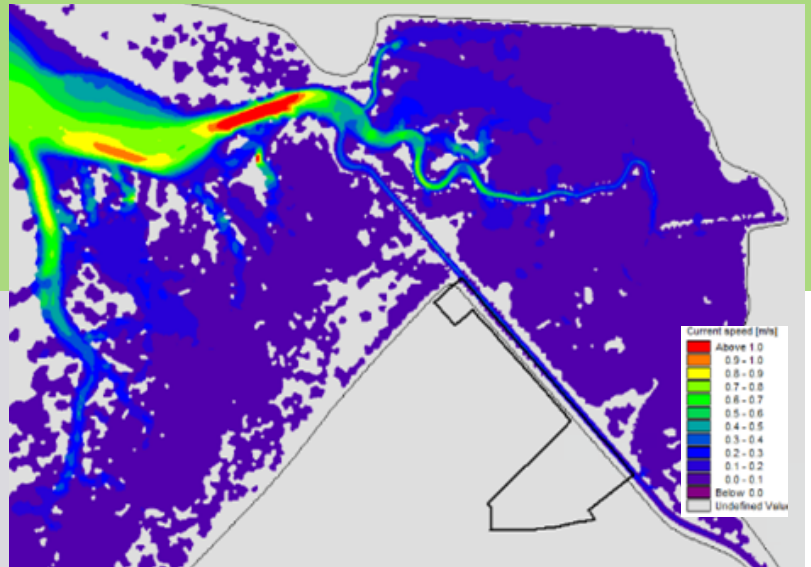
# Cocker Tidal Channel & Cockerham Marsh SSSI Restoration Investigation

## Task 2b Modelling: Summary

The Cocker Tidal Channel and Cockerham Marsh SSSI Restoration Investigation, led by Natural England, Lancashire Wildlife Trust and the Environment Agency, forms part of the wider Our Future Coast programme in North West England.

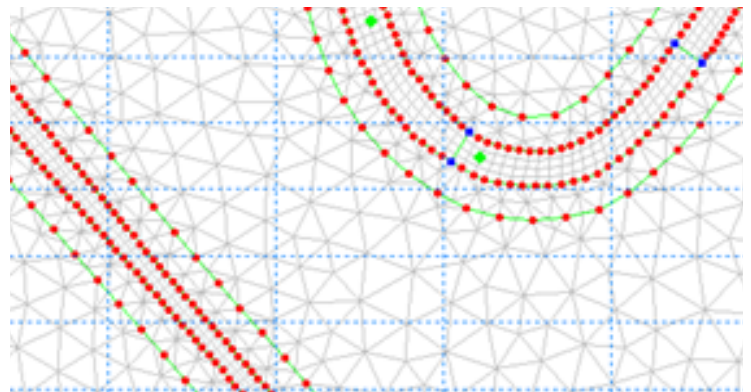
In 'Task 2b – Modelling', hydrodynamic modelling was used to understand how tides, river flows and channel configurations influence water levels, currents and inundation patterns across the Cocker Tidal Channel, Cockerham Sands and Cockerham Marsh SSSI. A nested MIKE21 hydrodynamic model was developed, using a regional Irish Sea model to drive a fine resolution local model covering the tidal Cocker Channel, Bank End Farm and Cockerham Marsh SSSI. Model inputs were built from 2023 LiDAR, UKHO/C Map bathymetry, and available long section channel surveys.

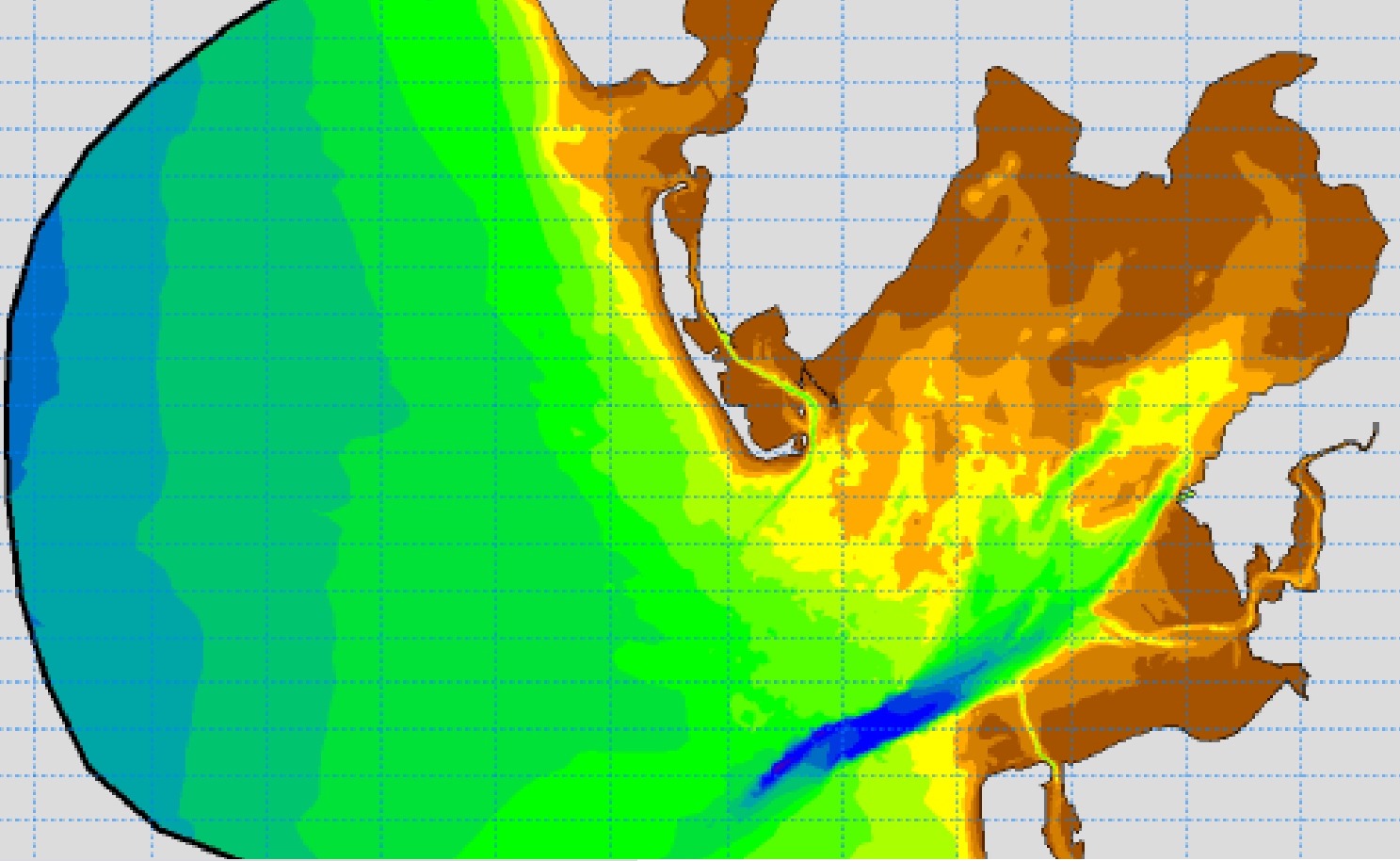
Verification against observed and predicted tides at Heysham and Fleetwood demonstrated excellent model performance. The model was then run for a full 14 day spring–neap cycle in September 2024 for six scenarios: (i) Baseline; (ii) and (iii) Baseline Sensitivity (two river-flow cases); (iv) Historic Baseline; (v) one Tidal Cocker Channel restoration option; and (vi) one Cockerham Marsh SSSI restoration option.



Baseline results show that neap tides remain confined to the main channels, while progressively larger tides inundate mudflats and, by the highest spring tide, most of the saltmarsh. A small triangular area of upper saltmarsh near the SSSI remains dry except during the single largest tide in the simulation period, suggesting possible suitability at this location for new natterjack toad habitat pools. Current velocities exceed 1 m/s in the Outer Cocker Channel during spring tides, consistent with known erosion tendencies near Bank End. River inflows (1.3 or 5 m<sup>3</sup>/s) have minimal influence on high water levels or tidal timing; tidal processes overwhelmingly dominate.

Historic Baseline modelling, simulating pre 1960s natural-channel conditions, shows that the former meandering channel retains water longer and conveys freshwater less effectively, causing tide locking and poorer drainage upstream. Reinstating the historic alignment would therefore likely worsen flood risk to hinterland areas adjacent to the fluvial Cocker and would not significantly enhance delivery of tidal processes to existing upper saltmarsh areas, and therefore provide no biodiversity enhancement opportunities.





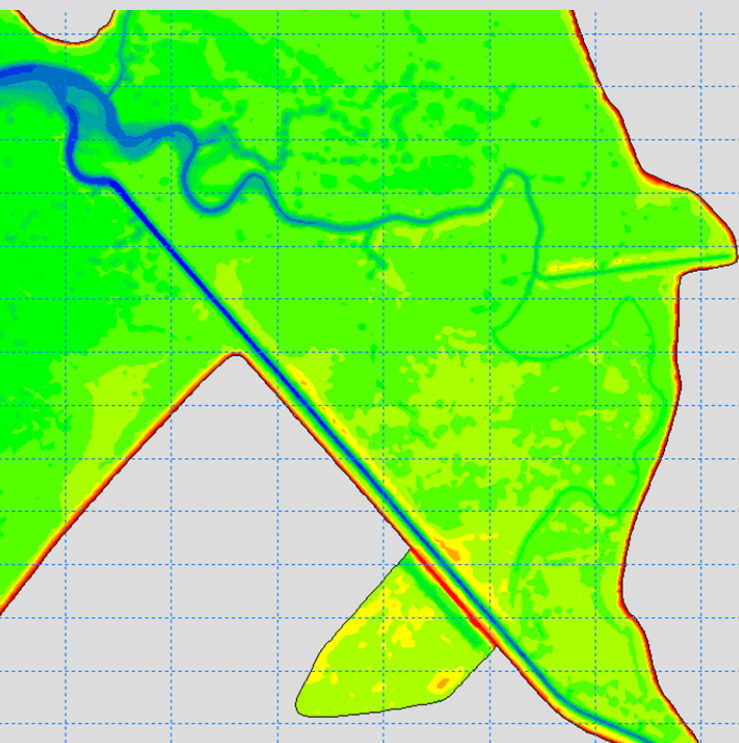
The modelled Cocker Tidal Channel reinstatement option (partial reinstatement of the natural channel while keeping the “new cut” open) produces only minor hydraulic differences from the present day. Small volumes of flow enter the reinstated channel during mid to spring tides, but overall inundation of the saltmarsh still occurs mainly from west to east due to over marsh flooding rather than via creeks.

A slight increase in ebb phase current speeds near Bank End suggests a potential marginal increase in local erosion risk under this option.

The modelled Cockerham Marsh SSSI restoration option (a single 40 m embankment breach) shows that tidal water reaches the SSSI only on mid to spring tides, initially filling the delph ditch immediately behind the flood embankment and then overspilling limited adjacent land areas within the SSSI.

Only the five largest spring tides in the simulation inundate a meaningful portion of the site, and even then some areas remain dry, requiring earthworks to improve hydraulic connectivity between pools/ponds on the SSSI. Engineering measures (namely a perimeter flood embankment) would also be necessary to prevent unwanted flooding of adjacent farmland.

Occasional tidal influence could technically be restored to the SSSI but this alone would not guarantee ecological success without ongoing site management.



Overall, the modelling confirms a strongly tide dominated system where channel modifications would provide limited ecological or flood risk benefits, while potentially creating new hydraulic risks. These findings directly informed the Task 2a Optioneering conclusions.

# Cocker Tidal Channel & Cockerham Marsh SSSI Restoration Investigation

## Task 3 Nature Based Solutions in the Cocker Catchment: Summary

The Cocker Tidal Channel and Cockerham Marsh SSSI Restoration Investigation, led by Natural England, Lancashire Wildlife Trust and the Environment Agency, forms part of the wider Our Future Coast programme in North West England.

**‘Task 3 – Catchment Nature Based Solutions’ identifies nature based solutions (NBS) that could help address two major catchment scale challenges in the River Cocker system: land drainage issues caused by poor outfall function and blocked tidal gates, and sediment supply from agricultural land that contributes to siltation in the channel and Morecambe Bay.**



Soil aerator

The report uses desk based analysis, LiDAR and land use data, flood risk mapping, and available modelling to understand catchment pressures and identify locations where NBS could be most effective.

Baseline data show that the lower catchment experiences high fluvial and surface water flood risk, particularly in low lying farmland adjacent to ordinary watercourses. Much of the catchment has soils vulnerable to erosion or nutrient loss, and water body classification data for the Cocker (Lune) water body indicate moderate ecological status, with phosphorus and ammonia pollution linked to agricultural activities.



Wetland creation



Cross-slope 'beetle bank'

Available modelling further highlights high runoff connectivity and erosion risk in the northern and central parts of the catchment, identifying likely sediment source areas. Using this evidence base, the study maps potential NBS options aimed at slowing surface flow, reducing sediment transport, and improving catchment hydrological function.

These are:

1. intercepting fast flow pathways;
2. installing floodplain or riparian woodland;
3. adding large woody material in channels;
4. enhancing riparian buffer strips;
5. cross slope beetle banks;
6. cover cropping and increasing grassland;
7. reducing stocking density;
8. wetland creation;
9. improving floodplain reconnection; and
10. improving soil quality.

Each option is spatially targeted using available modelling outputs, land use mapping, and floodplain delineation. The report notes that most interventions would be small scale and farm specific, requiring landowner engagement and more detailed design at future stages.



Cover crops



Large woody debris

The report concludes that NBS can help mitigate terrestrial sediment supply and improve land drainage by reducing rapid runoff and trapping sediments before they reach the Cocker Channel. These measures cannot address offshore sediment inputs into Morecambe Bay, but they can improve agricultural resilience, water quality, and the functioning of drainage infrastructure.

The accompanying GIS data and maps are intended to support the next phase of discussion between the Environment Agency, relevant agencies working on flood risk in the area and landowners on feasible site specific measures.

# Cocker Tidal Channel & Cockerham Marsh SSSI Restoration Investigation

## Task 4 Cockerham Marsh SSSI: Summary

The Cocker Tidal Channel and Cockerham Marsh SSSI Restoration Investigation, led by Natural England, Lancashire Wildlife Trust and the Environment Agency, forms part of the wider Our Future Coast programme in North West England.

‘Task 4 – Cockerham Marsh SSSI’ focuses on understanding the ecological baseline, restoration potential, management needs and biodiversity value of Cockerham Marsh SSSI. Whilst once being part of the upper saltmarsh of Cockerham Sands, the site is now dominated by floral species such as rush, reed, grass and scrub since its enclosure by a flood embankment in 1981.

The SSSI’s sole notified feature is the natterjack toad, which is currently in ‘unfavourable–declining’ condition, with no confirmed breeding at the site since 1987. Historical records show repeated failures to sustain the population due to drying pools, salinity changes, competition from common amphibians and loss of suitable habitat. Past attempts - including pond excavation, rush removal and multiple spawn translocations (2002–2004) - were unsuccessful.



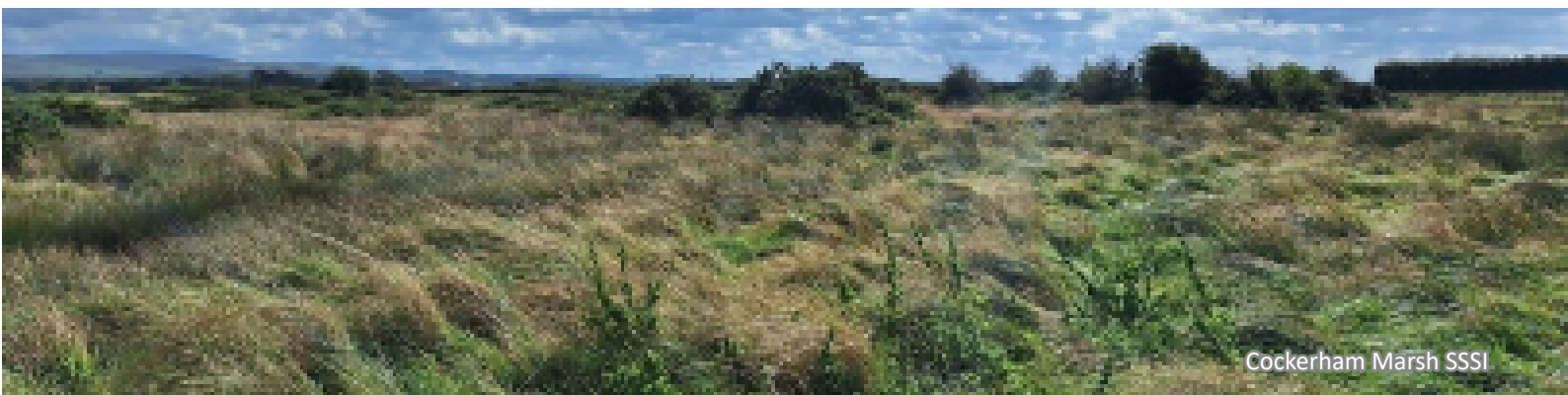
Cockerham Marsh SSSI

The study identifies three major long term pressures:

1. flood and coastal erosion risk management structures, particularly the 1981 flood embankment which cut off tidal influence;
2. scrub encroachment, dominated by gorse; and
3. undergrazing, resulting in extensive sea rush expansion.

These changes have progressively reduced the suitability of breeding pools and terrestrial habitat. Field surveys in 2025 confirmed that all historic natterjack ponds are now completely dry and overgrown, the grassland is unmanaged, and the site is dominated by neutral grassland, modified grassland, scrub and small wet ditches. No evidence of natterjack toads or other protected amphibians was found.

The survey also identified the presence or potential presence of important species including curlew, greylag geese, brown hare, roe deer, common frog, and occasional foraging bats. The adjacent coastal habitats form part of several nationally and internationally designated sites including Morecambe Bay SAC/SPA/Ramsar and Lune Estuary SSSI. These areas support large assemblages of wading and overwintering birds, with Cockerham Marsh providing some functionally linked land for these species.



Cockerham Marsh SSSI



Cockerham Marsh SSSI boundary

The report assesses restoration options at Cockerham Marsh SSSI, from embankment removal to regulated tidal exchange, saline treatments and pool creation. Although ecological restoration potential exists, the preferred option is **Do nothing**, due to high capital cost, large scale engineering requirements, flood risk implications for neighbouring land, need for long term maintenance and the lack of confidence that natterjack re establishment would succeed. Nevertheless, the study notes that tidal reinstatement remains theoretically feasible and may be reconsidered at a future date.



Gorse



Overgrown with grassland and scrub

If restoration were pursued later, significant management - scrub clearance, rush control, earthworks, grazing management and natterjack toad spawn or tadpole translocations - would be essential to create and maintain suitable breeding conditions.

The report provides an early stage Biodiversity Net Gain (BNG) assessment of the SSSI's present-day status, providing a baseline against which any future changes can be compared.



Natterjack toad