# Temporary Fallow Land Management Plan

## *Stodmarsh Stream Enhancement Scheme*

**Date: 07/08/2025** **Project ref. GSL14/Stodmarsh_ODG**

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**Version history**

| Version number | Produced by | Role | Date |
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| **V1** | Dr Gabriel Connor-Streich | Director and Principal Environmental Scientist | 07/07/2025 |
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# 1 Introduction

Under the Conservation of Habitats and Species Regulations (as amended) 2017 (the Habitat Regulations), aquatic Habitats Sites may have Conservation Objectives Supplementary Advice that identifies the need to manage elevated nutrient inputs[1]. Following a ruling in the Court of Justice of the European Union referred to as the 'Dutch N Case'[2], Local Planning Authorities (LPAs) now require planning applications to consider the potential impact that projects and plans may have on nutrient inputs to Habitats Sites that are not meeting nutrient-related conservation objectives. Where a project or plan is evidenced to increase nutrient inputs to a Habitats Site that is under pressure from nutrients, it will not be possible to conclude no 'adverse effects on integrity (AEoI)' through a Stage 1 Habitat Regulations Assessment (HRA). Thus, a project or plan will need to evidence how it will secure nutrient mitigation to remove the risk of AEoI on a Habitats Site. The evidence underpinning a mitigation scheme can then be used to support an HRA Appropriate Assessment (AA) showing how the project or plan can proceed without AEoI, thus achieving nutrient neutrality.

The Stodmarsh Special Area of Conservation / Special Protection Area / Ramsar site (hereafter the Stodmarsh Habitats Sites) has been identified as not meeting conservation objectives due to elevated levels of nitrogen (N) and phosphorus (P) inputs. As such, projects and plans that are evidenced to result in an increase in N & P inputs to the Stodmarsh Habitats Sites will require nutrient mitigation in order show compliance with the Habitat Regulations through an HRA. This requirement has placed a significant barrier on the ability for LPAs to grant planning permission for development across large areas of Norfolk, with the impacts being felt most acutely in the residential development sector.

Various private providers of N & P mitigation have begun to offer mitigation solutions within catchments affected by nutrient neutrality. Mitigation is being sold as N & P credits in units of kg TP/year and kg TN/year[3], to align with nutrient budgets for new developments which are also quantified in units of kg TP/year and kg TN/year. While mitigation schemes are beginning to bring N & P credits to market, the demand for nutrient mitigation is still outstripping supply, resulting in significant barriers to new development and resultant impacts on the local economy.

Agriculture is known to be a significant source of nutrient pollution to aquatic systems (Withers et al., 2014; Withers & Lord, 2002). As such, mitigation schemes targeting agricultural exports of N & P are a key tool for addressing the challenge posed by Nutrient Neutrality. Oliver Davis Group (ODG) Limited have engaged with Greenshank Environmental (Greenshank) to progress a mitigation scheme on farmland within the Stodmarsh Habitats Catchment. Nutrient mitigation from this scheme will be able to serve development in all settlements that contribute nutrients to the Stodmarsh Habitats Sites.

Greenshank and ODG are deploying a mix of mitigation options to generate temporary and permanent nutrient credits. This mix of nutrient credit types is in response to forthcoming Technically Achievable Limits (TAL) upgrades and associated changes to N and P permits at wastewater treatment works that are legally required to comply with the Levelling Up and Regeneration Act (LURA) 2023. These changes to permits mean that some

[1] E.g. Natural England. Site Improvement Plan, Stodmarsh.

[2] Joined Cases C-293/17 and C-294/17

[3] TP = total phosphorus, TN = total nitrogen

developments in the Stodmarsh Habitats Sites catchments require a larger quantum of nutrient mitigation up to 2030 and a reduced amount of mitigation in perpetuity from 2030. This mix of temporary and permanent credits are being deployed through the Stodmarsh Stream Enhancement Scheme (SSES), with permanent mitigation being delivered using the Enhanced Drainage Ditch Management approach (Connor-Streich, 2024a, 2024b) at seven sites across the catchment, while temporary credits are being generated through fallow land management of intensive agricultural land.

This report details the temporary fallow land management plan that shows how the SSES will deliver temporary nutrient credits for allocation to new residential developments. The approach to quantifying temporary nutrient mitigation is provided in Section 2, with further detailed descriptions of elements of this approach in Appendix A2. Section 3 evidences the fallow land management plan that will be used to deliver temporary nutrient mitigation at the site, with Section 4 showing how land management the site will be secured legally. A summary of the mitigation proposal is provided in Section 5.

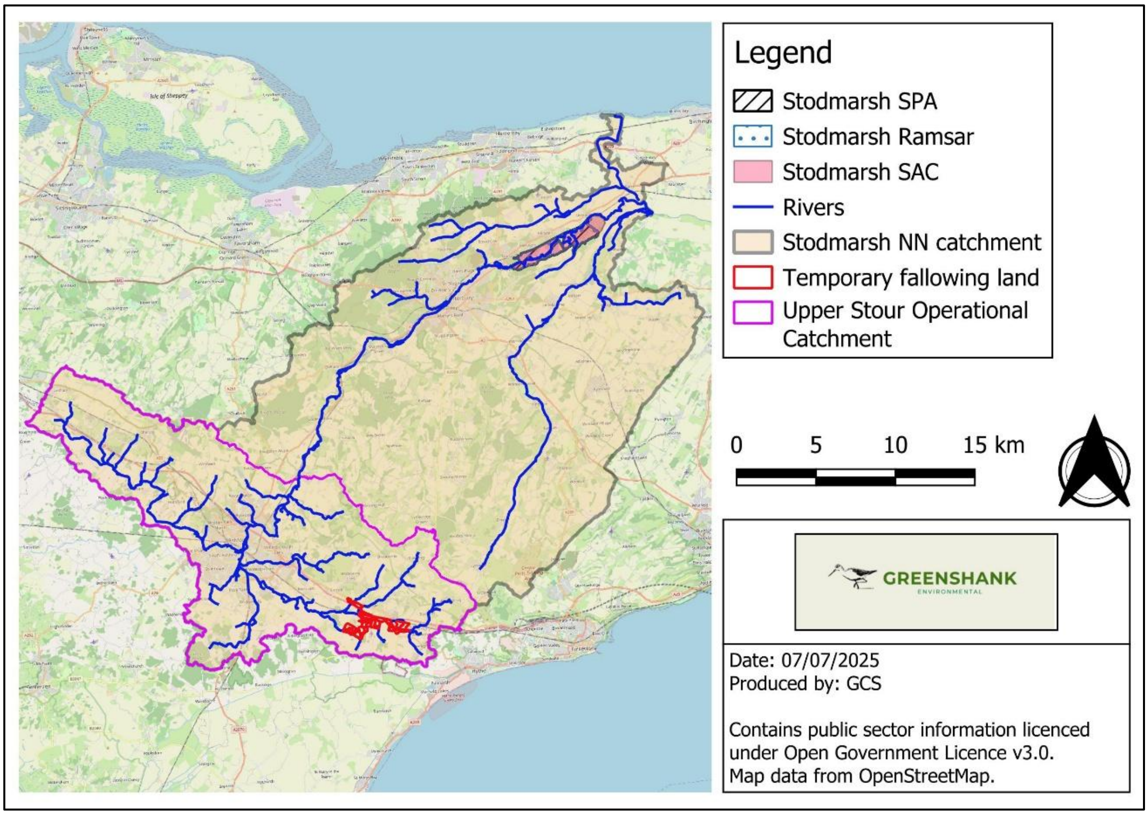


*Figure 1: The Stodmarsh Habitats Sites catchment and the location of the temporary fallow land within the Upper Stour Operational Catchment.*

# 2 Quantifying temporary nutrient mitigation

The approach to generating temporary mitigation through the SSES is based on the temporary cessation of intensive agricultural operations across 216.32 ha of land (see Appendix A1, Figure 2). This land is under the ownership of two landowners: R Price and Sons and Ben Jeanes (the Landowners). Temporary cessation of intensive agricultural operations on the land shown in Figure 2 will cease associated nutrient inputs and diffuse nutrient exports to the Stodmarsh Habitats Sites catchment. This in turn will provide a temporary nutrient offset that can be used to mitigate higher, pre-2030 nutrient credit requirements of much development within the catchment. The approach to quantifying the nutrient mitigation that will be delivered by the land shown in Figure 2 is detailed below.

## 2.1 Mitigation quantification

Quantification of the N and P reductions that the proposed scheme will deliver used nutrient export coefficients associated with the agricultural land use within the Upper Stour Operational Catchment. Temporary nutrient mitigation is being created through the avoidance of cereals cropping. Quantification of the impact of ceasing cereals farming on the land shown in Figure 2 used Farmscoper-derived export coefficients describing the per ha export of N and P. In order to account for the potential lag time from the point of cessation of agricultural operations to the impact of a reduced N and P export to the Stodmarsh Habitats Sites catchment, an exercise to calculate groundwater-corrected nutrient export coefficients was conducted. The analysis to produce these coefficients is detailed in Appendix A2. The relevant N and P export coefficients generated by this analysis provide a per ha assessment of the mitigation potential from temporary fallowing, following an approach that has been widely adopted by mitigation schemes based on fallow land management.

Crop Map of England (CROME) land use data were used to classify the land uses in each field for the most recent period for which CROME data were available (2016-2022). The landowners and managers of the land being used for this scheme were consulted to confirm that the CROME data provided an accurate representation of the farm type classification for each field shown in Figure 2. The landowners and managers confirmed that all land being used for the scheme is dominantly used for cereals cropping. To obtain relevant export coefficients for the temporary fallowing land, it is necessary to determine the rainfall, and dominant soil type and associated soil drainage class for each field. In line with guidance on selecting agricultural export coefficients (Ricardo & Natural England, 2022), soil drainage class was determined using the Cranfield Soil and Agrifood Institute's Soilscapes[4] dataset, with the exception of one field where field-specific information necessitated the selection of a different soil drainage class (see Appendix A3) and rainfall for the site was determined from the UK Centre for Ecology and Hydrology Gridded Estimated Areal Rainfall (CEH-GEAR) dataset (Tanguy et al., 2021). Further details on how the CEH-GEAR dataset was processed are provided in Appendix A4. Table 1 shows the areas of different farm types and their associated soil drainage classes

[4] Available from https://www.landis.org.uk/soilscapes/index.cfm, accessed on: 07/07/2025

and average annual rainfall bands across the field parcels shown in Figure 2, along with the relevant groundwater-corrected N and P export coefficients for this combination of input variables and the resultant mitigation. Note that all fields are within an NVZ.

The impact of the groundwater correction process (Appendix A2) on the export coefficients is, as would be expected, most significant for N on freely draining soils (Table 1). Where soils are freely draining, Farmscoper attributes the majority of N losses from agriculture to leaching pathways, whereas P losses to groundwater are significantly lower across all soil drainage classes as P binds more strongly to soils and is therefore less prone to reaching groundwater. P export coefficients from soils classed as having slightly impeded drainage are generally not that sensitive to the groundwater correction process as most of the P export is assumed to be in surface water runoff and drain flow, whereas a greater proportion of N loss on this soil drainage class is attributed to leaching pathways. Because both N and P loss is almost entirely assumed to be via surface water and drain flow pathways on impeded drainage soils, the export coefficients for this soil drainage class are largely unimpacted by the groundwater correction process.

*Table 1: Areas of different farm types and associated environmental variables that determine the groundwater-corrected nutrient export coefficients and nutrient export from the land subject to this fallow land management plan.*

| Farm type | Area (ha) | Soil drainage class | Average annual rainfall (mm/year) | N export coefficient (kg TN/ha/yr) | P export coefficient (kg TP/ha/yr) | N export (kg TN/yr) | P export (kg TP/yr) |
|---|---|---|---|---|---|---|---|
| Cereals | 186.42 | Impeded drainage | 700 to 900 | 22.01 | 0.93 | 4102.95 | 173.29 |
| Cereals | 13.49 | Slightly impeded drainage | 700 to 900 | 15.89 | 0.67 | 214.39 | 9.04 |
| Cereals | 16.41 | Freely draining | 700 to 900 | 1.96 | 0.13 | 32.15 | 2.06 |
| **Total** | **216.32** | | | | | **4349.49** | **184.39** |

Table 2 shows the steps completed to obtain the export coefficients and thus quantify the mitigation delivered through this fallow land management plan.

*Table 2: The steps, analysis, data and tools, and results and outputs from the quantification of temporary mitigation generation.*

| Step | Description of required analysis | Data and tools used | Results and outputs |
|---|---|---|---|
| **Map the land boundary** | A boundary for the fields being used for agricultural reversion was mapped using land registry title boundary data. This boundary was amended to cover only the | Tool: Geographic Information System (GIS; QGIS was used in this project) | The boundary of the mitigation site is shown Figure 2. |

| Step | Description of required analysis | Data and tools used | Results and outputs |
|---|---|---|---|
| | areas visible as cropped land within each field parcel. | Data: Index polygons spatial data (INSPIRE)[5] | |
| **ID nutrient generating land uses within the land boundary** | An assessment of whether the land being used to generate temporary nutrient mitigation will have nutrient generating land uses between now and 2030. | Data: Crop Map of England. Landowner confirmation of farming activities.<br>Tool: GIS for mapping areas of different crop types | Appendix A1, Figure 3 shows the nutrient generating land uses classified for each field being used in the temporary fallowing scheme. |
| **Determine annual average rainfall** | The annual average rainfall (AAR) for each field was required to select the relevant nutrient export coefficient for each farm type (see Table 1 and Appendix A2).<br>The AAR should be determined from a dataset representing the previous 30 years of available rainfall data. | Data: UK Centre for Ecology and Hydrology Gridded Estimated Areal Rainfall (CEH-GEAR) dataset (Tanguy et al., 2021).<br>Tool: *ncdf4* package (Pierce, 2023) in R Statistics (R Core Team, 2022)<br>Tool: *Zonal statistics* tool in QGIS | AAR for all fields is in the range 746 mm/year to 882 mm/year, which aligns to the 700 to 900 mm rainfall range required for selection in the Stodmarsh Nutrient Budget Calculator. |
| **Determine soil drainage class** | The soil drainage class for each mitigation field is required to select the relevant nutrient export coefficient for each farm type (Table 1). | Data: Cranfield Soil and Agrifood Institute's Soilscapes[6] dataset<br>Tool: GIS used to overlay the land boundary on the Soilscapes dataset | The relevant soil drainage for each field was determined and is detailed in Table 1. A map showing the soil drainage classes is also provided in Appendix 1, Figure 4. Where two soil drainage classes are present in a field, the field was divided into areas for each soil drainage class. |
| **Nitrate Vulnerable Zone (NVZ) check** | Whether the mitigation site is within an NVZ effects the nutrient export coefficient for each farm type. | Data: Nitrate Vulnerable Zones (NVZ) 2021 Designations (shapefile)[7]<br>Tool: GIS used to map data | All fields are within an NVZ (see Appendix A1, Figure 5) |

[5] Data available from: https://use-land-property-data.service.gov.uk/datasets/inspire/download, accessed on: 07/07/2025
[6] Available from https://www.landis.org.uk/soilscapes/index.cfm, accessed on: 07/07/2025
[7] Available from: https://www.data.gov.uk/dataset/77ffd32c-13db-4d83-a1f8-044c5397bc34/nitrate-vulnerable-zones-nvz-2021-designations, accessed on: 07/07/2025

| Step | Description of required analysis | Data and tools used | Results and outputs |
|---|---|---|---|
| **Identify the Operational Catchment** | The Water Framework Directive (WFD) Operational Catchment that the mitigation site is within effects the nutrient export coefficient for each farm type. | Data: WFD Surface Water Operational Catchments Cycle 2 (shapefile)[8]<br><br>Tool: GIS used to map data | The fields are within the Upper Stour Operational Catchment (Figure 1). |
| **Select nutrient export coefficient(s)** | Nutrient export coefficients for different farm types are available within the Natural England nutrient budget calculators for each NN catchment. These coefficients are selected using data obtained from the above steps. | Data: AAR range = 700 to 900 mm/yr<br><br>Data: Soil drainage class = Impeded drainage (see Table 1)<br><br>Data: Site is within NVZ<br><br>Data: Site within Upper Stour Operational Catchment | Using these inputs, the export coefficients shown in Table 1 were selected. |
| **Calculate mitigation potential** | Based on the area of each farm type and its relevant export coefficients, the mitigation that will be generated by the management plan was calculated.<br><br>The mitigation potential for the site needs to be adjusted to account for background nutrient export from the management of the site as a land use with no nutrient inputs. | Data: Export coefficients for each farm type<br><br>Data: Export coefficient for greenspace land use reflecting land management with no nutrient inputs (3 kg TN/ha/yr & 0.02 kg TP/ha/yr) | The temporary nutrient mitigation was calculated as follows:<br><br>*Impeded drainage soils:*<br><br>• 4102.95 kg TN/yr - 186.42 ha x 3 kg TN/ha/yr = 3543.68 TN/yr<br><br>• 173.29 kg TP/yr - 186.42 ha x 0.02 kg TP/ha/yr = 169.56 kg TP/yr<br><br>*Slightly impeded drainage soils*<br><br>• 214.39 TN/ha/yr - 13.49 ha x 3 kg TN/ha/yr = 173.91 kg TN/yr<br><br>• 9.04 kg TP/yr - 13.49 ha x 0.02 kg TP/ha/yr = 8.77 kg TP/yr<br><br>*Freely draining soils* |

[8] Available from: https://www.data.gov.uk/dataset/71581966-1935-411e-ab66-f32d960497e8/wfd-surface-water-operational-catchments-cycle-2, accessed on: 07/07/2025

| Step | Description of required analysis | Data and tools used | Results and outputs |
|---|---|---|---|
| | | | • 32.15 TN/yr - 16.41 ha x 3 kg TN/ha/yr = -- 17.07 kg TN/yr† <br> • 2.06 TP/yr - 16.41 ha x 0.02 kg TP/ha/yr = 1.73 kg TP/yr <br> **Total mitigation potential from temporary fallowing = 3700.52 kg TN/yr & 180.07 kg TP/yr** |

†Note that the negative TN mitigation from areas of freely draining soils is due to the very low groundwater-corrected N export coefficients such that the background export of N associated with no input land management is greater than the N export associated with surface water and preferential flow pathways in Farmscoper modelling. This negative mitigation potential reflects the temporary nature of the fallowing scheme, such that over short timescales the impact of the temporary fallowing may not be seen at the Stodmarsh Habitats Sites. The reality is that the temporary cessation of agricultural activities will result in an impact on the Stodmarsh Habitats Sites at some point in the future, with the time to impact being dictated by catchment hydrogeology. In effectively discounting the temporary N mitigation potential of the freely draining areas being used for this scheme, the scheme is made more precautionary.

# 3 Land management and monitoring plan

The aim of this management plan is to implement a temporary reduction in diffuse nutrient pollution through the cessation of nutrient generating land uses due to intensive agricultural operations. This plan will meet the aim through a temporary land management regime that will establish no input grassland across the fields shown in Figure 2. Greenshank Environmental will support landowners to ensure all reporting of monitoring actions is completed at the required frequency.

On land managed by Ben Jeanes, a hay meadow management plan using mechanical hay cutting will be delivered as detailed in Table 3.

*Table 3: Land management and monitoring actions to secure the generation of temporary nutrient mitigation on land managed by Ben Jeanes.*

| Actions | Description | Timeline / frequency |
|---|---|---|
| **Cessation of nutrient generating land use** | The fields under Ben Jeanes' management shown in Figure 2 will be removed from intensive agricultural production and nutrient generating land uses following end of the summer 2025 harvest season. | Summer-Autumn 2025 |
| **Establishment of grass cover** | Following removal of arable crops, grass cover will be established using a slow-growing and low maintenance grass seed mix, such as Naturescape N1 General Purpose Meadow Mixture. Landowners will be encouraged to also include supplementary wild bird or pollinator seed mixes where soil nutrient levels suggest establishment may be successful and improve biodiversity outcomes. | Autumn 2025 |
| **Maintain no input vegetation cover** | The Landowner will maintain the fields shown in Figure 2 in no input vegetation cover until at least May 2030, at which point the effect of the TAL upgrades to WwTWs in the Stodmarsh Habitats Sites catchment can be accounted for in development nutrient mitigation strategies and the requirement for this management plan falls away. Maintenance of vegetation cover will not involve any grazing, application of organic or inorganic fertiliser or liming. | Autumn 2025 to May 2030 |
| **Grassland management** | All fields will be maintained by taking an annual hay cut in late July or early August, with arisings collected and removed. Discretionary cuts may be taken in spring and autumn, dependent on growth rates and ground conditions to ensure no additional problems of ground compaction and soil erosion. | Annually from Autumn 2025 until May 2030 |
| **Routine boundary maintenance** | Landowners may continue routine maintenance to boundary features such as fences, hedgerows and other semi-natural habitats. | Annually from Autumn 2025 until May 2030 |

| Actions | Description | Timeline / frequency |
|---|---|---|
| **Soil testing** | An annual soil test to assess nutrient levels will be conducted on request. Soil nutrient levels may not decrease year-to-year as it can take an extended time for soil nutrients to decrease following a cessation of fertiliser inputs, especially for P. The expectation would be that soil nutrients levels would not increase year-to-year and may decrease over the management plan period. | July 2026 to July 2029 |
| **Produce monitoring report** | Site photographs will be provided annually following the July / August hay cut. Other relevant records submitted to the Rural Payments Agency and collected by the landowners as part of their standard agricultural operations, such as fertiliser applications, will be collated. Fertiliser purchase records for pre and post the onset of the scheme will also be obtained to show a reduction in fertiliser purchases and thus use due to the scheme. Site photos, soil testing outputs and other relevant records will be collated into a monitoring report evidencing that the fields are being maintained as no input grass meadows. | Annually in September from 2026, with a final report in May 2030 |
| **Submission of monitoring report** | The monitoring report will be made available to any body enforcing the management plan. | Annually in September from 2026, with a final report in May 2030 |
| **Maintain a ledger of credit allocations** | All nutrient credits allocated from the scheme will be logged in a ledger that will be used to show that credits are not being double counted. This ledger will be made available to the body enforcing the management plan and to all relevant Local Planning Authorities. | Summer 2025 until April 2030. |

On land managed by R Price & Sons, a management plan has been developed to incorporate a single season of no input wheat cropping on one land parcel, with the remaining land parcels shown in Figure 2 being put into temporary grassland managed using conservation grazing. Appendix A5 details an approach to one season of no input wheat cropping that is aligned to the aim of this plan to reduce diffuse nutrient pollution to the Stodmarsh Habitats Sites and shows the field parcel proposed for this part of the management plan.

*Table 4: Land management and monitoring actions to secure the generation of temporary nutrient mitigation on land managed by R Price and Sons.*

| Actions | Description | Timeline / frequency |
|---|---|---|
| **Cessation of nutrient** | The fields under R Price’s management shown in Figure 2 will cease all nutrient inputs and thus | Summer-Autumn 2025 |

| Actions | Description | Timeline / frequency |
|---|---|---|
| **generating land use** | nutrient generating land uses following end of the summer 2025 harvest season. | |
| **No input winter wheat cropping** | The field shown in Figure 9, Appendix A5, will be cropped with one season of winter wheat (winter 2025/26), as the Landowner considers that the soil nutrient levels are still sufficient to obtain reduced yield wheat crop.<br><br>There will be no application of organic or inorganic fertiliser, or liming. To manage potential impacts of nutrient export due to silt runoff, a 15 m grass buffer strip will be established around all field margins. | Winter 2025/26 |
| **Establishment of grass cover** | Arable crops will be removed and grass cover established using a slow-growing and low maintenance grass seed mix, such as Naturescape N1 General Purpose Meadow Mixture. Landowners will be encouraged to also include supplementary wild bird or pollinator seed mixes where soil nutrient levels suggest establishment may be successful and improve biodiversity outcomes. | Barring the field shown in Figure 9, grass cover will be established in autumn 2025<br><br>In the field shown in Figure 9, grass cover will be established in spring 2026. |
| **Maintain no input vegetation cover** | The Landowner will maintain the fields shown in Figure 2 as no input vegetation cover until at least May 2030, at which point the effect of the TAL upgrades to WwTWs in the Stodmarsh Habitats Sites catchment can be accounted for in development nutrient mitigation strategies and the requirement for this management plan falls away. | Autumn 2025 to May 2030 |
| **Conservation grazing** | Maintenance of permanent vegetation cover will use conservation grazing techniques. The Landowner will maintain a maximum stocking density of 0.25 livestock units (LU) per ha. This low stocking density will mean no requirement for supplementary feeding of livestock. There will be no application of organic or inorganic fertiliser, or liming. | Autumn 2025 to May 2030 |
| **Routine boundary maintenance** | The Landowner will continue routine maintenance to boundary features such as fences, hedgerows and other semi-natural habitats, noting the requirement to maintain boundaries suitable for retaining livestock within fields. | Annually from Autumn 2025 until May 2030 |

| Actions | Description | Timeline / frequency |
|---|---|---|
| **Collate stocking density records** | The Landowner will need to collate and provide records of the number of LU and associated stocking densities for all fields under conservation grazing management. | Annually from August 2026 to August 2029 |
| **Soil testing** | An annual soil test to assess nutrient levels will be conducted on request. Soil nutrient levels may not decrease year-to-year as it can take an extended time for soil nutrients to decrease following a cessation of fertiliser inputs, especially for P. The expectation would be that soil nutrients levels would not increase year-to-year and may decrease over the management plan period. | July 2026 to July 2029 |
| **Produce monitoring report** | Site photographs will be provided annually in July / August. Other relevant records submitted to the Rural Payments Agency and collected by the landowners as part of their standard agricultural operations, such as fertiliser applications, will be collated. Fertiliser purchase records for pre and post the onset of the scheme will also be obtained to show a reduction in fertiliser purchases and thus use due to the scheme. Site photos, soil testing outputs, livestock data, fertiliser purchase records and other relevant records will be collated into a monitoring report evidencing that the fields are being maintained as no input grass meadows / a single no input winter wheat crop in the field shown in Figure 9, Appendix A5. | Annually in September from 2026, with a final report in May 2030 |
| **Submission of monitoring report** | The monitoring report will be made available to any body enforcing the management plan. | Annually in September from 2026, with a final report in May 2030 |
| **Maintain a ledger of credit allocations** | All nutrient credits allocated from the scheme will be logged in a ledger that will be used to show that credits are not being double counted. This ledger will be made available to the body enforcing the management plan and to all relevant Local Planning Authorities. | Summer 2025 until April 2030. |

# 4 Securing the fallow land management plan

Delivery of this fallow land management plan will be secured using a Conservation Covenant. The Covenant will be entered into between each landowner participating in the scheme, with RSK Biocensus acting as the Responsible Body. Conservation Covenants were created by the Environment Act 2021 (Part 7) and are a new legal instrument for the purpose of securing conservation benefits for the natural environment. They are legally binding agreements between the landowner and a Responsible Body, which will covenant the landowners to manage the land shown Figure 2 in accordance with the management plan detailed in Section 3. The Covenant runs with the land, being linked to land titles within which the land being used for the scheme sit, and the obligations secured by the Covenant become a local land charge. As a result, a Conservation Covenant has legal equivalence with a voluntary S106 agreement that is the alternative legal instrument that could be used to secure the delivery of a nutrient mitigation scheme.

The Conservation Covenant will establish management period from point of execution of the Covenant (likely to be in August 2025) until May 2030. During this period Greenshank Environmental, working on behalf of the landowners, will submit monitoring reports to the Responsible Body, in line with the monitoring requirements secured by the Covenant. These monitoring requirements may not include the reporting of nutrient credit allocations to the Responsible Body, as the Responsible Body is primarily concerned with enforcing the management of the land in accordance with the plan detailed herein. Greenshank and ODG will therefore maintain an online ledger of nutrient credit allocations that will be shared with all LPAs within the Stodmarsh Habitats Sites catchment. This ledger will include the planning application references and the volume of nutrient credits allocated to each application, as well as the total credit capacity of the scheme, providing a traceable resource that will show that credits from the scheme are not being double counted.

The landowners participating in the scheme are to be bound by a contractual agreement that:

a) Requires them to enter into a Conservation Covenant that will enforce delivery of this fallow land management plan.
b) Stipulates the remuneration each landowner will receive for the delivery of the fallow land management plan.
c) Assigns the benefit from the fallow land management plan, in the form of the nutrient credits as detailed in Section 2, to Greenshank Environmental and ODG for the purpose of onward allocation to planning applications within the Stodmarsh Habitats Sites catchment.

By combining the Conservation Covenant, the credit allocation ledger and a contractual mechanism that facilitates the management of the resultant nutrient credits by Greenshank Environmental and ODG, this fallow land management plan will be legally secured to provide nutrient mitigation for new residential development within the Stodmarsh Habitats Sites catchment.

# 5 Summary

This report presents the technical details supporting the delivery of a temporary nutrient mitigation scheme on land near Selindge, Kent. Nutrient mitigation will be generated through the temporary cessation of farming and associated nutrient inputs on 245.94 ha of cereals farming and lowland grazing. The land is located within the Upper Stour catchment and thus is able to provide mitigation to new development that will increase nutrient loading to the Stodmarsh Habitats Sites.

Agricultural activities are the main source of diffuse nutrient pollution to receiving waterbodies. Through the temporary cessation of agricultural activities and the implementation of a fallow land management plan, nutrient mitigation will be generated by avoiding the nutrient exports associated with the present agricultural land use. The sale of temporary nutrient credits will be used to offset the losses from removing the land from agricultural production until at least May 2030. To quantify the nutrient mitigation potential of the site, it was necessary to determine the N and P export associated with the current agricultural land use.

The existing nutrient export from 216.32 ha of intensive agricultural land use was determined using nutrient export coefficients that describe the per ha N and P output from cereals farming. A set of groundwater-corrected export coefficients for the Upper Stour catchment were generated using a methodology that follows the process used to generate the nutrient export coefficients that are available in the Natural England Nutrient Budget Calculators. To determine the correct nutrient export coefficients for the relevant farm types, rainfall and soil drainage characteristics were determined and used to select relevant export coefficients. The area under each land use was then multiplied by the relevant export coefficient to calculate the N and P export that will be avoided by the cessation of agricultural operation until May 2030. The baseline N and P export was revised down to account for background N and P fluxes that will result from maintaining site in a miscanthus crop. **The resulting mitigation potential of the site was estimated at 3700.52 kg TN/yr & 180.07 kg TP/yr.**

In order to deliver the nutrient mitigation potential of the site, a fallow land management and monitoring plan was produced. This plan details a set of actions that will provide evidence that the fields that are the subject of this the plan will be maintained as no input land uses until May 2030. These actions will be secured using a Conservation Covenant, with credits allocated to developers using Credit Purchase Agreements and tracked in a credit allocation ledger.

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# Appendices

## Appendix A1

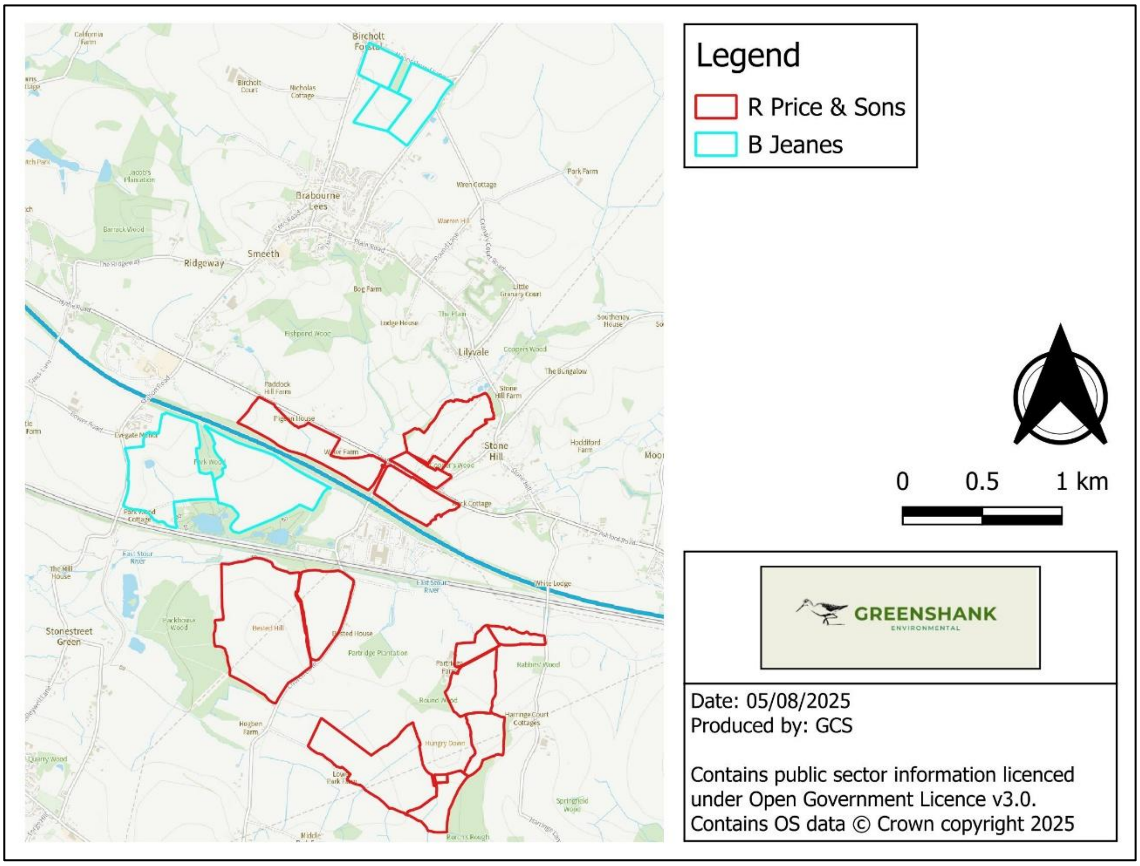


*Figure 2: Map of land under the ownership of the Landowners that is being entered into a temporary fallow land management plan.*

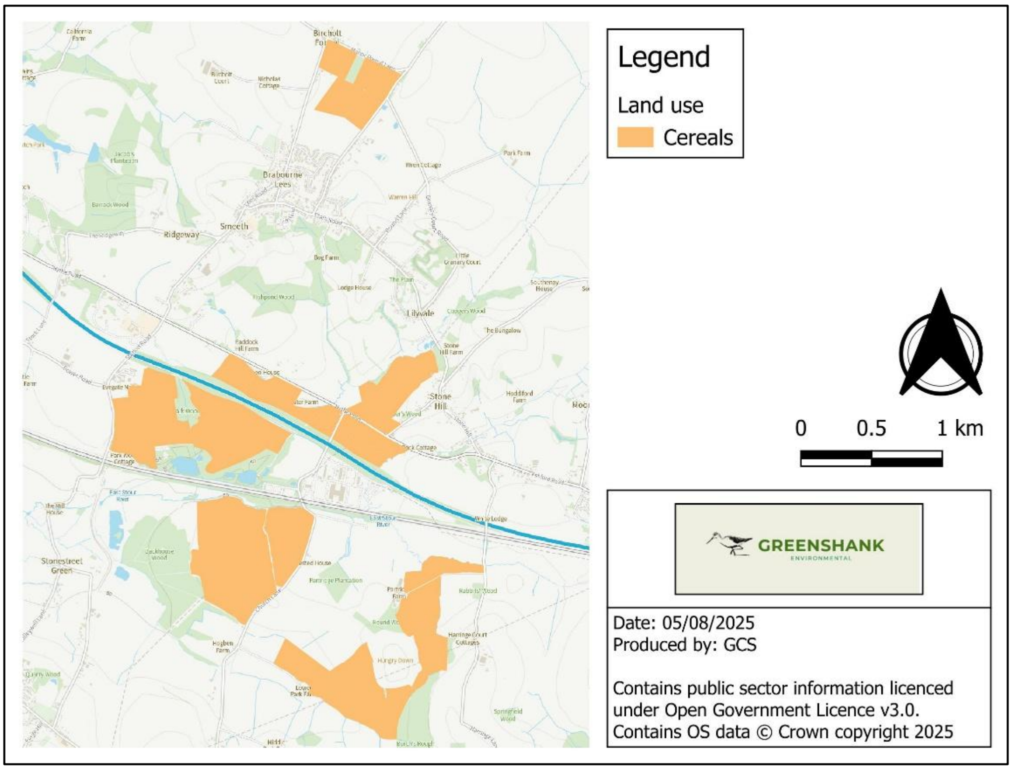


*Figure 3: Farm types mapped from Crop Map of England data and confirmed by the Landowner of the temporary fallowing land.*

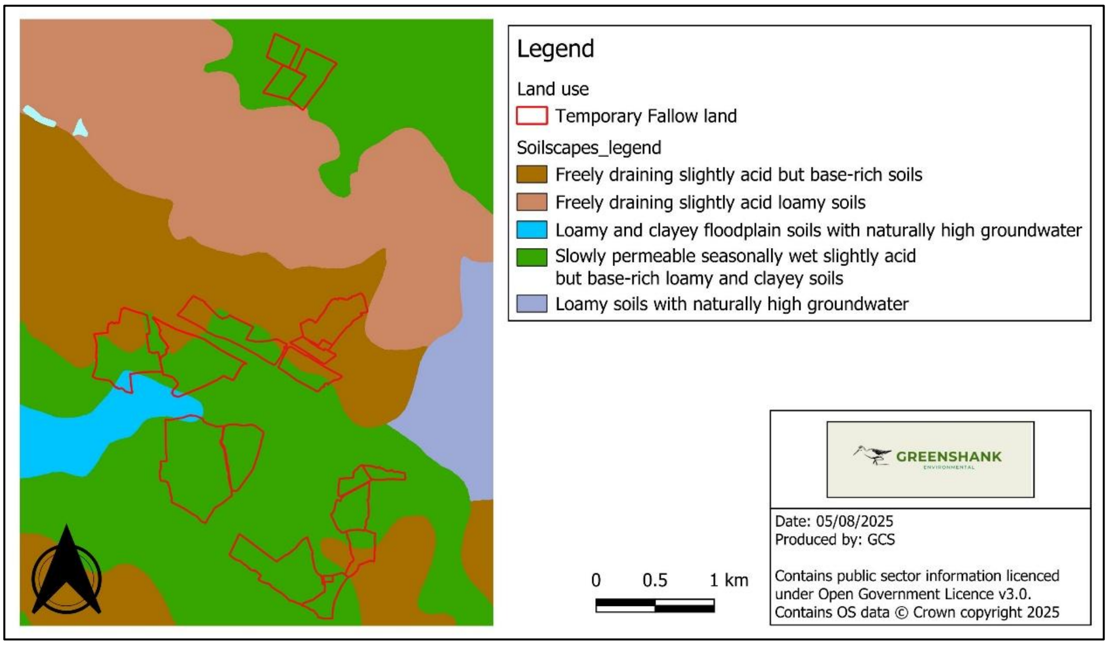


*Figure 4: The temporary fallowing land overlain on Soilscapes soil type mapping.*

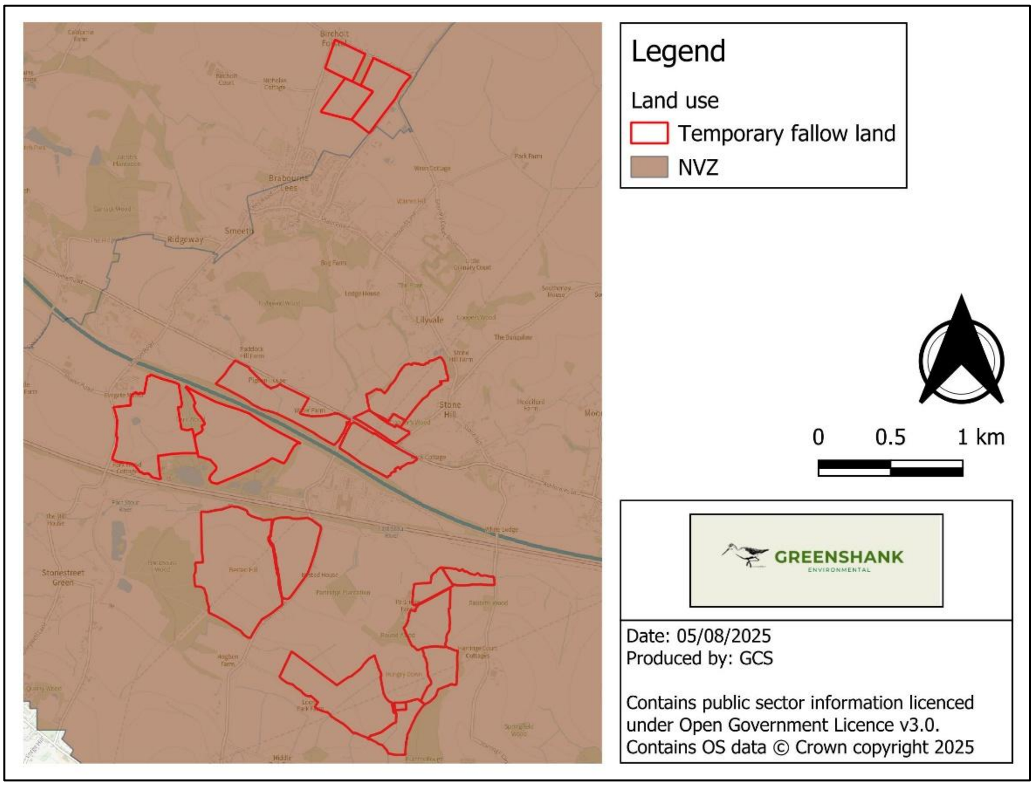


*Figure 5: The temporary fallowing land overlain on Nitrate Vulnerable Zones (NVZ) mapping*

# Appendix A2

# Correcting nutrient export coefficients to account for nutrient losses to groundwater

Nutrient export coefficients describing the nutrient export from land uses in the Stodmarsh catchment have previously been generated for the NE Stodmarsh Nutrient Budget Calculator and were derived from a Farmscoper modelling exercise. The use of these export coefficients has become standard practice in assessments of mitigation scheme potential. However, these export coefficients include the loss of N and P via a combination of surface runoff, preferential flow (i.e., in field drains and soil macropores) and leaching to groundwater. Losses of nutrients to groundwater may result in lag times before the impact of the cessation in agricultural activities has an impact on a Habitats Site. To remove the risk of impact lag times, N and P lost along leaching pathways was removed from the export coefficients, enabling the calculation of groundwater-corrected nutrient export coefficients for calculating temporary mitigation.

## Data sources

The data required to remove the leaching pathway from the nutrient export coefficients is held in a set of Farmscoper Evaluate files that can be output when running the Farmscoper Upscale module that is used to generate data for conversion to export coefficients. The pathway-specific nutrient loss data held in the Farmscoper Evaluate files for each combination of farm type, rainfall, soil drainage and NVZ class were analysed to determine corrected nutrient export coefficients by removing N and P loss to groundwater.

## Data processing, analysis and assumptions

To derive a set of nutrient export coefficients corrected for groundwater loss, the nutrient export was isolated for each loss pathway associated with each combination of farm type, rainfall, soil drainage and NVZ class. This was achieved by analysing the individual Farmscoper Evaluate files that are output for each combination of farm type and environmental characteristics when Farmscoper is run using the Upscale module. Within the individual evaluation files, the 'Loss Data' worksheet contains data on the losses of nutrients attributable to each component of a modelled farm, including the pathway for nutrient losses (Figure 6). The 'Leaching' pathway describes the estimated nutrient losses to groundwater. Thus, by removing all nutrient losses attributed to the leaching pathway and summing the remaining nutrient losses associated with the surface runoff and preferential flow pathways, it was possible to obtain an estimate of the total export of nutrients that will be reduced by the mitigation scheme without any significant lag time. Following the methodology used to calculate the nutrient export coefficients provided in the NE Nutrient Budget Calculators, the total nutrient export along non-groundwater pathways was divided by the average farm area for each farm type within the mitigation option sub-catchment to derive a groundwater-corrected per ha nutrient export coefficient.

| Item | Pollutant | Source | Area | Pathway | Type | Timescale | Form | Baseline Value | Prior Value | New Value |
|---|---|---|---|---|---|---|---|---|---|---|
| Component | Nitrate | Beef | Arable | Preferential | FYM | Short | Dissolved | 0.07 | 0.05 | 0.05 |
| Component | Nitrate | Beef | Arable | Runoff | FYM | Short | Dissolved | 0.09 | 0.05 | 0.05 |
| Component | Nitrate | Beef | Arable | Preferential | Slurry | Short | Dissolved | 0.02 | 0.01 | 0.01 |
| Component | Nitrate | Beef | Arable | Runoff | Slurry | Short | Dissolved | 0.02 | 0.01 | 0.01 |
| Component | Nitrate | Beef | Arable | Preferential | FYM | Medium | Dissolved | 1.79 | 1.60 | 1.57 |
| Component | Nitrate | Beef | Arable | Runoff | FYM | Medium | Dissolved | 0.10 | 0.08 | 0.07 |
| Component | Nitrate | Beef | Arable | Leaching | FYM | Medium | Dissolved | 1.18 | 1.14 | 1.11 |
| Component | Nitrate | Beef | Arable | Preferential | Slurry | Medium | Dissolved | 0.64 | 0.58 | 0.57 |

*Figure 6: An extract from the Loss Data worksheet within a Farmscoper Evaluate file. One of the rows is highlighted to show the quantum of nitrate losses due to leaching to groundwater associated with this component of the modelled farm. The losses (in kg/year) for different mitigation scenarios are shown in the final three columns.*

The nutrient export coefficients in the NE Nutrient Budget Calculators also accounted for the impact of compliance with agricultural regulations through the implementation of two different mitigation scenarios. These scenarios applied different rates of on-farm mitigation methods to reflect farm management that is mandatory for regulatory compliance and farm management that may be 'reasonably' required to comply with Farming Rules for Water (reasonable) regulations. To align with the approach taken in the generation of the NE Nutrient Budget Calculator nutrient export coefficients, final groundwater-corrected nutrient export coefficients were calculated using the following steps:

- Calculate 15% of the difference between the export coefficients from the mandatory regulatory compliance scenario and the Farming Rules for Water (reasonable) scenario.
- Subtract the 15% difference from the export coefficients for the mandatory regulatory compliance scenario.

The final output from this data analysis procedure is a single set of nutrient export coefficients that account for both regulatory compliance and losses of nutrients to groundwater and are thus appropriate for calculating the nutrient export from cessation of agricultural operations, accounting for lag times.

# Appendix A3

# Field-specific soil drainage classification

The land under ownership of R Price and Sons that is proposed for temporary fallow land management comprises a mix of soil types and associated drainage classes (see Figure 4). These soil drainage classes influence the nutrient export coefficients that are selected as part of the process of determining the baseline nutrient export from a given field. The Landowner was consulted as to whether the soil types and associated drainage classes are an accurate representation of actual soil drainage characteristics across his landholding. It was confirmed that for the most part the soil drainage classification was accurate, albeit there are some fields that are classed as freely draining but that do have old tile drain networks that have not been maintained and are no longer functioning that effectively. Because the soils in these fields drain well enough without a well-maintained tile drain network, the Landowner has not needed to maintain them. These fields were subsequently classed as freely draining soils with low nutrient export coefficients. However, there is one field that is mapped as being on freely draining soils but that still has an active tile drain network that discharges directly into a stream that borders the field to the north (Figure 7).

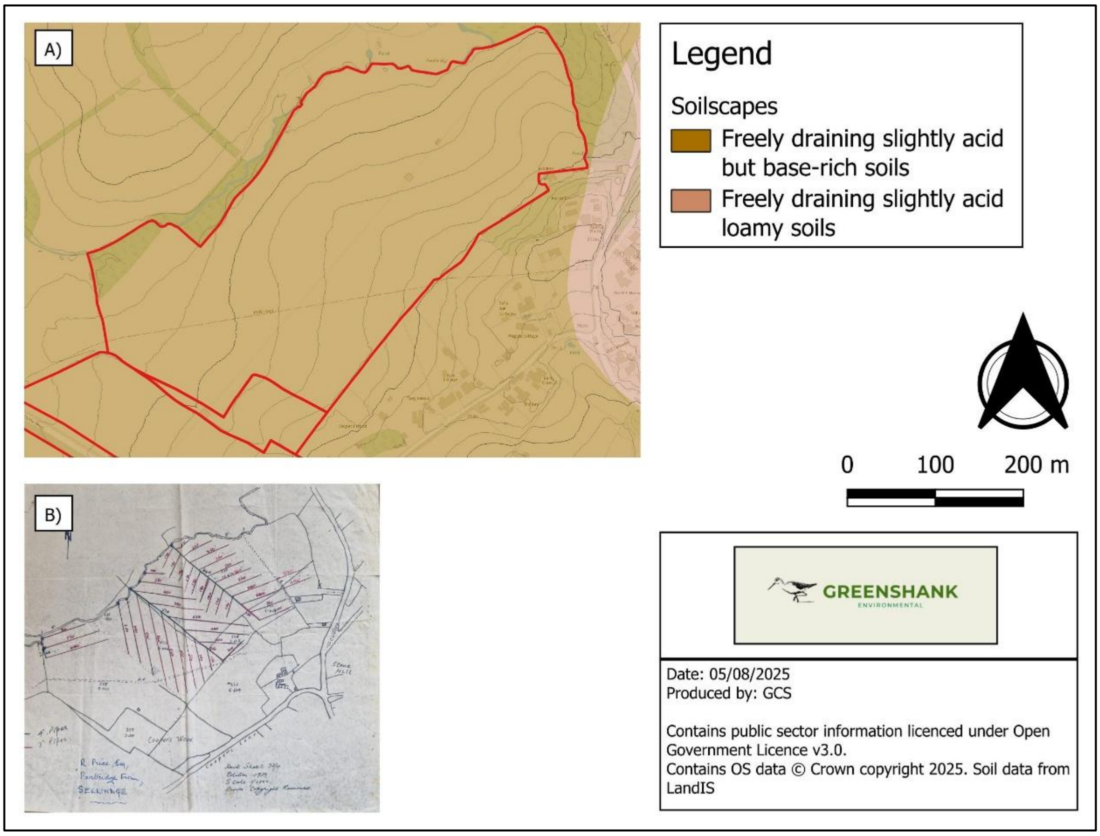


*Figure 7: A) a field within the R Price and Sons' ownership that is mapped as having freely draining soils on the Soilscapes soil map but is drained using underdrainage. Contours are also shown; b) a drainage plan showing the network of tile drains.*

The Soilscapes dataset, while generally reflecting soil characteristics well, is a national dataset that will not capture the true heterogeneity of soil characteristics at field scales. Hence, landowners and managers may need to drain soils in areas that are mapped as being on freely draining soils, as is the case with the field shown in Figure 7. The NE Nutrient Budget Calculator methodology for generating nutrient export coefficients using Farmscoper mapped Soilscapes soil drainage classes to the three soil drainage classes used in Farmscoper, as follows:

- Soilscapes 'freely draining' soils = Farmscoper 'free draining' soils.
- Soilscapes 'slightly impeded drainage' soils = Farmscoper 'drained for arable' soils.
- Soilscapes 'impeded drainage' and 'naturally wet' = Farmscoper 'drained for arable and grassland' soils.

The Farmscoper 'drained for arable' and 'drained for arable and grassland' soil drainage classes refer, respectively, to farms where all arable areas are drained but grassland areas may not be and farms where both arable and grassland areas are drained. Groundwater-corrected export coefficients for 'drained for arable and grassland' soils are higher than for 'drained for arable' soils, because the former soil drainage category assumes greater losses of both N and P to receiving waterbodies via surface runoff and preferential flow pathways.

In the case of the field shown in Figure 7, this is a cereals field with tile drains and thus the more precautionary Farmscoper soil drainage classification that reflects the actual drainage characteristics of the field is 'drained for arable', which was used when selecting the relevant nutrient export coefficients for this field. As can be seen in Figure 7b, the main drain network in the field consists of two sets of tile drains that join collector drains following the main direction of slope within the field. Outfalls for these collector drains are shown in Figure 8. There are two areas without mapped drains: one to the southwest of the field and one to the northeast of the field. The Landowner described these parts of the field as being dominated by surface runoff due to a combination of slope and soil that do not drain that freely. In the southwest corner of the field, gradient lessens towards the northern field boundary, and this causes problems with waterlogging, hence the drains in this part of the field shown in Figure 7b. In the northeastern area of the field surface runoff and shallow throughflow rapidly enters the stream at the field boundary due to the short distance to the watercourse. As such, this area of the field is not drained but has similar hydrology to the drained areas of the field.


*Figure 8: Outfalls for the two main collector drains shown in Figure 7b. Note the outfall shown the left image is coming out of the bank of the stream visible in the right image.*

# Appendix A4

# Use of CEH-GEAR to estimate rainfall

The CEH-GEAR dataset covers a period from 1890-2019. Monthly average rainfall estimates were acquired from 1989-2019 in order to capture the previous 30 years of rainfall estimates, based on the standard definition of 30 years of weather observations being required to calculate climate averages (WMO, 2021). CEH-GEAR data were compiled using the *ncdf4* package (Pierce, 2023) in R Statistics (R Core Team, 2022). Monthly rainfall totals for each year from 1989-2019 were first summed to obtain a raster map where each grid cell for a given year held the estimated total annual rainfall for that 1 $km^2$. The mean rainfall for each grid cell for the 30-period was then calculated from the annual totals to obtain a single raster map where each cell contained an estimated annual average rainfall (AAR) value for further analysis. This raster map was then queried for each cell overlying the fields shown in Figure 2, with the rainfall values recorded for use in selecting the relevant nutrient export coefficients.

# Appendix A5

# No input wheat cropping as part of a temporary fallow land management plan

R Price and Sons consider that the field shown in Figure 9 has sufficient soil nutrients to support a winter wheat crop without fertiliser input, recognising this may have a notable impact on wheat yield. The Landowner intends to cultivate the field with wheat in winter 2025/26 prior to it being put into grass for the remainder of the management plan period. It is recognised that this is a slight departure from a standard fallow land management plan, which would see all land being taken out of arable production. It was therefore important to consider any risks to the reductions in nutrient exports that are expected to be delivered through this fallow land management plan. These risks are two-fold: firstly, there was a consideration as to whether the wheat crop will perform a similar function to grass cover in terms of nutrient storage; secondly, there was a consideration of the risks associated with sediment mobilisation during crop establishment and harvest.

Industry standard nutrient management guidance indicates that wheat has a typical P content ranging from approximately 0.33% P (grain only) to 0.36% P (considering both the grain and straw), while fresh grass generally has a P content ranging from approximately 0.33% P to 0.35% P (AHDB, 2023a, 2023b). These ranges are based on data for P in dry matter to aid comparison and suggest that wheat and grass have similar levels of P storage in biomass, with wheat potentially being slightly higher. Some studies of the impact of fertiliser on wheat yields use control plots growing wheat without fertiliser. These studies have shown that wheat yields are, as would be expected, notably reduced in the absence of fertiliser, but also that the crops do establish and there is a still a yield of wheat which tends to decrease over time as available soil nutrients are exhausted (Rafiullah et al., 2021; Shrivas et al., 2024). There is also considerable research highlighting the benefits of cover crops on nutrient management (e.g., Christopher et al., 2021; Skaalsveen et al., 2019) and in the present context, a no input winter wheat crop would effectively be acting as a cover crop. Indeed, the nutrient removal benefit of a winter wheat crop may be greater than traditional cover cropping, which generally involves incorporating cover crops into soil at the end of winter to provide nutrients to spring crops, whereas removal of wheat and associated nutrients will remove nutrients from the catchment. This combined analysis thus shows that a no input winter wheat crop is likely to be at least as effective, if not more effective, than grass establishment at reducing nutrient export from the field shown in Figure 9.

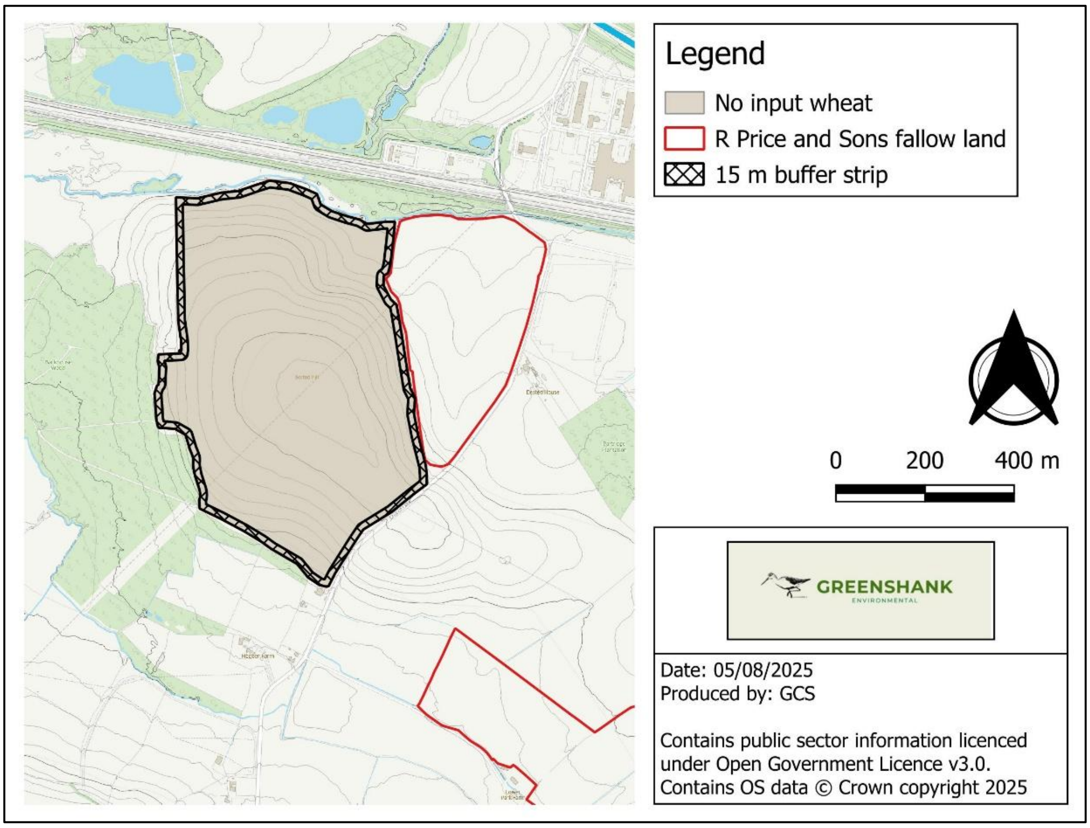


*Figure 9: Field proposed for one season of no input winter wheat cropping and showing the extent of a 15 m buffer strip at the field margins.*

Establishment of a wheat crop will require tilling and drilling of wheat seeds into a seed bed. Row crops leave more exposed soil than is found in grassed fields due to tramlines and a period of limited vegetation cover post-harvest. As such, there is a greater risk of sediment and associated nutrient mobilisation in winter 2025/26 than would be expected when the field is lain into temporary grass cover from spring 2026. To mitigate this risk, this management plan proposes the establishment of a 15 m wide grass buffer strip around the edge of the field. As can be seen in Figure 9, the field centres on the top of a hill and slopes downwards towards four of its five sides. Buffer strip establishment at field margins should therefore provide protection against sediment mobilisation.

The width of the buffer was selected based on a review of literature on nutrient dynamics in buffer strips. The processes that result in nutrient reductions in buffer strips are generally more effective when they have more time to act on surface and subsurface nutrient fluxes. A number of studies suggest that width is positively related to nutrient retention efficiency (Feld et al., 2018; Lind et al., 2019; Zhang et al., 2010). Many studies recognise that width is a proxy for the other factors that drive nutrient reductions in buffer strips and there is a general consensus that a minimum buffer width of 10-15 m will increase the probability achieving higher nutrient reduction efficiencies (Cole et al., 2020; Collins et al., 2009; Dorioz et al., 2006; Lind et al., 2019; Pärn et al., 2012; Zhang et al., 2010). This is reflected in guidance on the use of buffer strips that sets a minimum buffer width of 10 m to be used when deploying a buffer strip to generate nutrient mitigation (Lloyd et al., 2024; noting that in the present case it is the cessation of nutrient inputs that is generating nutrient mitigation and a buffer strip is being used to ameliorate legacy nutrient mobilisation risks).

Taken together, the use of a buffer strip and the potentially greater nutrient removal resulting from harvesting a no input wheat crop compared with establishing grass managed with conservation grazing suggests that this aspect of the management plan does not create additional risk of achieving the stated reductions in nutrient export from the field shown in Figure 9. Combined with soil testing and fertiliser purchase records that can be provided as evidence to support monitoring of the management plan (see Table 4, Section 3), this should provide sufficient certainty that a single season of no input wheat in one field is still aligned to the overall aim of this fallow land management plan.