

Land off Mill Lane, Whitburn

Wader Compensation Strategy

July 2026

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Contents

1	Introduction.....	6
2	Wader compensation site – design requirements.....	7
3	Earthworm survey	9
4	Compensation proposals.....	11
5	Legal delivery mechanism for compensation proposals	12
6	Action plan for compensation proposals	13
7	Monitoring plan for compensation proposals	15
8	References	18
9	Photographs	19
10	Figures.....	21
11	Appendix 1: Supporting evidence for the wader compensation strategy	22

1 Introduction

Background to commission

- 1.1 BSG Ecology Ltd. was commissioned by Story Homes (the 'Client') in October 2024 to undertake ecological surveys in support of an Ecological Impact Assessment (EclA) that was used to inform a planning application for a proposed residential development at Land off Mill Lane, Whitburn ('the Site'). The EclA (see BSG Ecology, 2026a) is supported by a suite of bird surveys which was collected between November 2024 – October 2025. The full results are presented in the Ornithological report (see BSG Ecology, 2026b).
- 1.2 The Site is evaluated to be of regional level importance for non-breeding curlew *Numenius arquata* (see BSG Ecology, 2026a). Therefore, an offsite bird compensation strategy was sought suitable to remediate impacts primarily to curlew but also golden plover *Pluvialis apricaria* and lapwing *Vanellus Vanellus*.
- 1.3 Consultation with the ecologist at the local planning authority (LPA), South Tyneside, on 6 October 2025 was undertaken in relation to the scope of an offsite compensation strategy. To collect further information on the foraging suitability of the fields for compensation, an earthworm survey was undertaken on 21 November 2025. A further consultation with the LPA ecologist was had on 2 June 2026 to discuss the comments made within the planning response and further considerations necessary when revising the compensation strategy.

Description of project

- 1.4 The client submitted a full planning application on 30 January 2026 (planning reference: 260049) for a residential development of 205 units with associated sustainable urban drainage features and public open space. The ecology surveys to inform the planning application were undertaken in accordance with industry standard guidance (CIEEM, 2018¹) and have been used to inform the final development design taking the mitigation hierarchy into account.

Site description

- 1.5 The Site boundary is approximately 10.7 hectares (ha) in size, and it is located adjacent to the east of Lizard Lane, Whitburn, South Tyneside. To the east of the Site is the A183 and to the north of the Site is Kitchener Road. The Site is centred on an Ordnance Survey grid reference (OSGR) of NZ 40564 63396. The Site is shown on **Photograph 1, Section 9** and **Figure 1, Section 10**.
- 1.6 The Site comprises of a single arable field, managed for haylage. There are no significant field margins, and the boundaries are delineated by dry stone wall or post and wire fencing. Scattered scrub is present along the western boundary.

Purpose of the report

- 1.7 The purpose of this report is to detail the proposed compensation strategy for non-breeding curlew. The design requirements are set out to provide long-term foraging and roosting habitat for birds which will be displaced by the proposed development during its construction and operational phase.

¹ CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.3 (September 2024). Chartered Institute of Ecology and Environmental Management, Winchester.

2 Wader compensation site – design requirements

- 2.1 In appraising the design requirements for a compensation site, the potential management solutions were informed by baseline data collected during the non-breeding wader surveys (see BSG Ecology, 2026a and 2026b), relevant peer-reviewed literature (see **Table A-1, Appendix 1**) and details in relation to the current land management and visual sight lines for waders.
- 2.2 Land to the west of the Site has been identified as a suitable receptor site for non-breeding wader compensation (the 'Compensation Site'). The Compensation Site is made up of a combination of two fields (Field 1 and Field 2); a description of each field is outlined below. The Compensation Site totals approximately 13.06 ha in size.
- 2.3 The location of the Compensation Site is shown on **Figure 1, Section 9**. The post intervention habitats proposed including additional fencing is shown on **Figure 2, Section 9**.

Field 1

- 2.4 Field 1 is approximately 7.77 ha in size and is currently modified grassland and used for livestock (horse) grazing (see **Photograph 2, Section 9** and **Figure 1, Section 10**). It is located to the west of the Site on the opposite side of Lizard Lane. Field 1 is centred on an Ordnance Survey grid reference (OSGR) of NZ 40370 63423. The sward height averages between 5 – 10 cm and evidence suggest that occasional poaching has occurred from livestock; however, this accounts for less than 5% of the habitat area and much of the grassland shows no physical damage. Grass species include: dominant perennial ryegrass *Lolium perenne*, with occasional cocksfoot grass *Dactylis glomerata* and Yorkshire fog *Holcus lanatus*. The eastern and south-west boundaries are marked by post and wire fencing. Alongside the fencing to the south is a newly planted hedgerow. To the west of Field 1 there is an earth mound which is fenced off on all aspects.
- 2.5 The results of the non-breeding wader surveys indicate that curlew and lapwing were using Field 1 in the presence of grazing livestock with a peak count of 13 curlew using Field 1 on the February high tide survey, recorded on five of the surveys in total (see Figure 5b of BSG Ecology, 2026b) and a peak count of 32 lapwing using Field 1 on the September low tide survey (see Figure 10a of BSG Ecology, 2026b) with lapwing recorded on a total of three of the surveys. It is considered that intensive grazing practices during the core over-wintering period may be limiting its frequent use by curlew due to disturbance from horses. A move to optimum grazing management prescriptions, including a reduction from intensive grazing to a more moderate grazing practice (see literature cited in **Table A-1, Appendix 1**) will increase attractiveness of the field and its carrying capacity through diversification of the grassland sward resulting in an increase in invertebrate diversity (Vickery *et al.*, 2001) coupled with a reduction in human and livestock disturbance during the core over-wintering period for non-breeding curlew (October – February).
- 2.6 Clear lines of sight are available within Field 1 particularly on the north and north east aspects. This will enable waders to transition between open fields unobstructed for foraging and roosting purposes. Site lines to the south are currently clear, however there is a newly planted hedgerow along the southern extent of Field 1 (see **Photograph 4, Section 9**) which is still currently immature with protective guards on each plant. This hedgerow will be managed to maintain a low height (< 1.2 m) and maintain open sight lines here. A description of its management and monitoring is detailed in **Section 6 and Section 7** of this report.
- 2.7 Lines of sight within the Proposed Development Site are already restricted to the south and east by housing, a school and road infrastructure. The open land to the north and south of Field 1 offers greater sight lines and transitions between open fields out-with of the Wader Compensation Site.

Field 2

- 2.8 Field 2 is approximately 5.29 ha in size and was made up wholly of a winter-sown arable crop (see **Photograph 3, Section 9**). Around the margins of the field is a narrow (0.5 m) strip of modified grassland dominated by grasses such as perennial ryegrass, cock's foot grass and Yorkshire fog. Along the northern boundary of the field is a newly planted hedgerow. The hedgerow measures

approximately 0.75 km in length and is entirely contained within tree tubes. The southern and south-west margins of the field are marked by an old stone wall which has vegetated over, giving the appearance of a mound.

- 2.9 The results from the non-breeding wader surveys (BSG Ecology, 2026b) indicate that curlew, lapwing and golden plover were using Field 2. Curlew and lapwing were the most abundant, and frequent. A peak count of 49 curlew was recorded in Field 2 on the January crepuscular survey (see Figure 4c of BSG Ecology, 2026b), recorded on eight of the surveys in total (see Figure 5b of BSG Ecology, 2026b) and a peak count of 53 lapwing using Field 1 on the September low tide survey with lapwing recorded on a total of two of the surveys. A winter cereal crop is suboptimal for foraging curlew due to the tilling and ploughing events which typically take place on an annual basis (see literature cited in **Table A-1, Appendix 1**). This management destroys intact earthworm burrow systems which ultimately increases foraging difficulty and energy expenditure (see Berg, 1993 and Bertoneclj, 2025) in **Table A-1, Appendix 1**).
- 2.10 Field 2 offers clear lines of sight to the south and to the south-west where arable fields are widespread in the locality allowing transition between fields. To the north is a farm track which divides Field 1 and Field 2. However, there is a newly planted hedgerow along the northern extent of Field 2 (see **Photograph 5, Section 9**) which is still currently immature with protective guards on each plant. This hedgerow will be managed and will be maintained a low height (< 1.2 m) to maintain open sight lines to the north. A description of its management and monitoring is detailed in **Section 6 and Section 7** of this report.

3 Earthworm survey

- 3.1 Earthworms are considered an important food resource during the pre-breeding period for waders, including curlew (Berg, 1993). Therefore, earthworm surveys were undertaken to determine densities at the Wader Compensation Site to ensure that fields have the suitability to support foraging non-breeding waders.

Methodology

- 3.2 The Proposed Development Site and proposed wader compensation fields (as shown in **Figures 1 and 2, Section 10**) were subject to an earthworm survey on 21 November 2025. The surveys were conducted by Harry Glass and Jennifer Peacock, Ecologists at BSG Ecology. Both have worked as ecological consultants since 2024 and have experience undertaking a variety of protected species surveys across the UK.
- 3.3 Survey conditions were dry, full sunshine and 4°C. Survey methods followed guidance set out by the Agricultural and Horticultural Development Board (AHDB) (2024). A total of ten soil pits 20 x 20 x 20 cm were dug at roughly evenly spaced locations throughout each of the three fields (Proposed Development Site and Field 1 and 2 of the Wader Compensation Site).
- 3.4 A plan showing the earthworm pit locations can be found in **Figure 3, Section 10**.
- 3.5 Surveyors hand-sorted the soil from the pit, tallying the worms that were dug up. Results were used to draw comparative conclusions regarding the density of earthworms between each field (and thus the relative availability of foraging resource for waders).

Consideration as to the potential limitations to methods

- 3.6 During the winter when conditions are cold, earthworms can begin to enter a state of dormancy and bury deeper into the soil to seek warmer temperatures (Spurgeon, 2001). The earthworm survey within the Site and the Wader Compensation Site was undertaken in November in temperatures above freezing. However, it is considered reasonable that some earthworms may have already buried deeper into the soil which may have reduced the densities of earthworms caught per sampling pit. Although a spring or summer sample may increase the number of earthworms caught per sampling pit, a single earthworm survey during the winter is not considered to be a significant limitation as it has provided a representative sample to inform this report.
- 3.7 At the time of the earthworm survey (and as submitted in the first version of this report in January 2026), the extent of Field 1 to be used as part of the Wader Compensation Site was approximately 3.51 ha in size. Since then, the extent of Field 1 to be used as part of the Wader Compensation Site has increased to approximately 7.77 ha. Although the full extent of Field 1 has not been surveyed for earthworms, the proportion of land that was surveyed is in the same land use as the remainder of the field (modified grassland; horse grazed) and therefore this is considered to still be a representative sample of earthworm densities here and is not considered to be a significant limitation.

Results

Site

- 3.8 The earthworm survey recorded poor numbers of earthworms on Site, averaging 1.4 earthworms per pit with a peak count of 4 worms. It is considered likely that the recent tilling and sowing of the field in the weeks prior to the survey is likely to have impacted the number of worms recorded, however this is considered to reflect the typical baseline of the Site under its current management.

Compensation Site – Field 1

- 3.9 The earthworm survey recorded the highest number of worms in the livery field west of the Site with an average of 8.4 worms per pit and a peak count of 20 worms, likely due to the livery use providing biological inputs to the soil and increasing its suitability for worms.

Compensation Site – Field 2

- 3.10 Lower numbers were recorded in the off-site agricultural field, averaging 3.4 worms per pit and a peak count of 7 worms, likely because of its agricultural management.

Evaluation

- 3.11 The results showed that the Wader Compensation Site had more earthworms per pit than the Site and noticeably higher earthworm densities overall.

4 Compensation proposals

Field 1

4.1 It is proposed that 'Field 1' (see **Figure 2, Section 10**) will be managed and function in the following ways, in perpetuity:

- Field 1 will continue as livestock grazed pasture (g4 Modified Grassland) within its 7.77 ha extent; however, the grazing regime will change through management modifications. All livestock will be removed between 1 October and 29 February.
- Livestock grazing between March to September will produce a varied sward height and inputs of dung will provide favourable conditions for invertebrates and foraging waders (see Berg, 1993., Vickery *et al.*, 2001, Atkinson, 2004, Lovasz, 2004 and Barzan, 2021 in **Table A-1, Appendix 1**). The removal of livestock between October and February will reduce disturbance induced by livestock (and people tending to their livestock) throughout the core wintering season (October – February). The proposed livestock management regime should make the field more attractive to foraging waders and increase its overall carrying capacity;
- Access to the land will be strictly controlled by the installation of appropriate fencing of which is considered necessary to reduce disturbance (see Cutts *et al.*, 2024 in **Table A-1, Appendix 1**); and
- Signage indicating restricted access will be installed in appropriate locations around the perimeter fence. It is recommended that signage (such as interpretation boards) is installed for the purpose of maintaining authorised access only and deterring access from new residents associated with the proposed development. The signage should include descriptions and advisory notes on the waders present for educational awareness purposes. In reference to Appendix C of BSG Ecology (2026d), the landscape masterplan shows that key recreational footpaths are focused on the north and east aspects of the Site with public footpaths directed away from the Wader Compensation Site.

Field 2

4.2 It is proposed that 'Field 2' (see **Figure 2**) will be managed and function in the following ways and secured for in perpetuity:

- Field 2 will be changed from its current use from winter-sown arable wheat crop (c1 Arable and horticulture) to a permanent grass ley (g4 Modified Grassland), analogous to the habitat present within the Site;
- Access to the land will be strictly controlled by the installation of appropriate fencing of which is considered necessary to reduce disturbance (see Cutts *et al.*, 2024 in **Table A-1, Appendix 1**);
- Providing permanent grassland will deliver long-term optimum foraging habitat for over-wintering waders through a decrease in ploughing/tilling events, reducing damage to earthworm densities. This has been found to increase wader foraging efficiencies (see Berg, 1993, Onrust, 1989 and Vickery, 2001 in **Table A-1, Appendix 1**). Re-seeding events will likely only need to be undertaken approximately every 5-years in order to replenish the seed mix. There will be flexibility as to the grass ley seed mixture sown in order to maintain soil health and organic matter content which is important for grass ley establishment; and;
- Access to Field 2 will be restricted after the final hay cut each October until the following year. This practice is considered to be part of the normal agricultural regime. Two hay cuts are typical of this grassland (one early summer and one in late summer/early autumn). Whilst curlew are able to forage in a short and a long grass swards, it is recommended that a third hay cut (late October) is undertaken to maintain a short sward (approximately 5 cm) over the winter to increase the appeal for foraging golden plover and lapwing, both species of which prefer feeding within a short sward (see Woodward, 2022; Vickery, 2001 and Milsom *et al.*, 1996 in **Table A-1, Appendix 1**). The short-term disturbance events required for the hay cuts is not likely to be detrimental to the birds using the field following the completion of these agricultural activities.

5 Legal delivery mechanism for compensation proposals

- 5.1 The measures proposed within this wader compensation strategy will be secured through a Section 106 agreement.
- 5.2 Management measures identified in this report are proposed to start at commencement of the development. This will allow opportunity for measures to be implemented as soon as possible for the benefit of non-breeding curlew.
- 5.3 During the term of the agreement of which measures will be secured for in perpetuity, Story Homes will be responsible for implementing the plan, via the farmer and landscape contractor where necessary (see **Section 6**).

6 Action plan for compensation proposals

- 6.1 The details of key management tasks and responsible parties associated with the delivery of the wader compensation strategy are outlined in **Table 1**.

Table 1: Management and monitoring tasks associated with the wader compensation strategy

Management Prescription	Responsibility	Timing	Construction Period	Activities in each year post-construction (measures will be secured in perpetuity but an illustrative plan showing the first five years is presented below)				
				Year 1	Year 2	Year 3	Year 4	Year 5 +
Field 1: Livestock grazed pasture (g4 Modified Grassland)								
Installation of signage indicating strictly no access to the field during the period of 01 October – 29 February.	Story Homes (SH) via a farmer (FR) / Landscape Contractor (LC)	Signage to be kept in situ all-year round.	✓					
Installation of interpretation signage on perimeter fencing for educational awareness of wader compensation measures.	SH via the LC	Signage to be installed during construction period and kept in situ all year-round.	✓					
Removal of grazing livestock during the cessation in grazing period.	SH via the FR	Horses will be removed between 01 October and 29 February.	✓	✓	✓	✓	✓	✓
Manage newly planted hedgerow on its southern boundary to a height of < 1.2 m	SH via FR / LC	Late winter (preferably January to mid-February), prior to the breeding bird season in March.	✓	✓	✓	✓	✓	✓
Monitor compensation prescriptions for Field 1	SH via SE (Site Ecologist)	October – November	✓	✓	✓	✓	✓	✓
Field 2: Permanent grass ley (g4 Modified Grassland)								
Installation of interpretation signage on perimeter fencing for educational awareness of wader compensation measures.	SH via FR / LC	Signage to be installed during construction period and kept in situ all year-round.	✓					

Undertake two to three hay cuts per annum	SH via FR	One hay cut in early summer, one cut later summer and a third in October (third cut dependant on whether re-seeding is required).	✓	✓	✓	✓	✓	✓
Re-seeding of grass ley	SH via FR	Late summer / early autumn	✓					✓
Manage newly planted hedgerow on its southern boundary to a height of < 1.2 m	SH via FR / LC	Late winter (preferably January to mid-February), prior to the breeding bird season in March.	✓	✓	✓	✓	✓	✓
Monitor compensation prescriptions for Field 2	SH via SE	October – November	✓	✓	✓	✓	✓	✓

7 Monitoring plan for compensation proposals

7.1 As stated in **Section 5** of this report, the compensation measures for waders within the Compensation Site will be secured for in perpetuity. **Table 2** summarises the monitoring requirements for each management feature detailed above for the initial 30 years. It is considered that this process will be repeated for in perpetuity.

Table 2: *Monitoring timetable for management features*

Feature	Monitoring visits (years of wader compensation implementation)																
	Year																
	Responsibility	Timing	Construction period	1	2	3	4	5	6	7	8	9	10	15	20	25	30
Field 1 (livestock grazed; Modified Grassland)																	
Monitor installation of appropriate restricted access and interpretation signage	SH via SE (Site Ecologist)	During construction period with an additional check in Year 5 in case of any damage.	✓			✓							✓				✓
Monitor field 1 to ensure that horses have been removed and not reinstated during the restricted grazing periods. Coordination should be achieved during wader bird	SH via SE	Late September / latest (01 October) with a return visit late February (latest 29 February)	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓

monitoring surveys)																	
Monitor hedgerow to ensure correct management procedures are being followed	SH via SE	February	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓
Undertake wader bird monitoring surveys to ensure that compensation methods are effective	SH via SE	Four visits during the over-wintering period at one per month (November – February).	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓
Field 2 (permanent grass ley; Modified Grassland)																	
Monitor installation of appropriate restricted access and interpretation signage	SH via SE (Site Ecologist)	During construction period with an additional check in Year 5 in case of any damage.	✓			✓							✓				✓
Monitor hedgerow to ensure correct management procedures are being followed	SH via SE	February	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓
Undertake wader bird monitoring surveys to ensure that compensation	SH via SE	Four visits during the over-wintering period at one per	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓

methods are effective		month (November – February).															
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9 Photographs

Photograph 1: Site (looking east)	Photograph 2: Field 1 of the Wader Compensation Site (looking north)
	
Photograph 3: Field 2 of the Wader Compensation Site (looking north)	Photograph 4: Newly planted hedgerow on the southern boundary of field 2 of the Wader Compensation Site
	

Photograph 4: *Newly planted hedgerow on the southern boundary of field 2 of the Wader Compensation Site*



10 Figures

(Overleaf)

Figure 1: Overview of Wader Compensation Site

Figure 2: Wader compensation strategy – post intervention UKhab map

Figure 3: Earthworm survey – sampling pit locations



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PROJECT TITLE
LAND OFF MILL LANE, WHITBURN

DRAWING TITLE
Figure 1: Overview of Wader Compensation Site

DATE: 27/05/2025
DRAWN: RSM
CHECKED: AP
APPROVED: IH
SCALE: 1:3,000
VERSION:1.0

Legend

Field 1

Field 2



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PROJECT TITLE
LAND OFF MILL LANE – RESUBMISSION

DRAWING TITLE
Figure 2: Wader Compensation Strategy Post
Intervention UKhab Map

DATE: 29/06/2026
DRAWN: CS
CHECKED: AP
APPROVED: AP
SCALE: 1:3,000
VERSION:1.0

- Legend
- Fence
 - Wall
 - Modified grassland
 - Site boundary



- Legend
- Sampling pit
 - Survey boundary

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PROJECT TITLE
LAND OFF MILL LANE, WHITBURN

DRAWING TITLE
Figure 3: Earthworm survey - Sampling pit locations

DATE: 12/01/2026
DRAWN: BH

CHECKED: AP
APPROVED: IH

SCALE: 1:3,500
VERSION:1.0

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Area measurements for indicative purposes only.

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Sources: BSG Ecology survey data

11 Appendix 1: Supporting evidence for the wader compensation strategy

- 11.1 A review of published evidence from research in the UK and Europe suggests that grass ley during the over-wintering period provides foraging opportunities for waders (particularly curlew) due to reduced ploughing/tilling events, resulting in more intact earthworm burrow systems and increased prey availability and increasing foraging efficiencies for waders (compared to annual ploughing or tilling of cereal crop fields).
- 11.2 Within the literature review, we have also considered grazing management and potential indirect impacts, including disturbance, and methods of reducing such disturbance events which include a cessation in grazing during the core over-wintering period.
- 11.3 A summary of the evidence for the effectiveness of grass leys and methods of reducing disturbance impacts to waders are presented below, some methods of which have been adopted within this wader compensation strategy (see **Section 4**).
- 11.4 **Table A-1** provides a literature review.

Table A-1: Literature review

Earthworms, grass leys and their benefits for foraging waders	
Author(s)	Summary of key findings
Berg, A. (1993). Food resources and foraging success of Curlews <i>Numenius arquata</i> in different habitats. The Swedish University of Agricultural Sciences.	Earthworms were found to be the most important food organisms for curlew during the pre-breeding period with the number of earthworms caught per minute by curlew is higher in sown grassland than tillage. It was suggested that the biomass of earthworms did not differ between these habitats, so the greater availability of earthworms in sown grass was probably due to their intact burrow systems, making earthworms easier to catch than in tillage, whereas tillage destroys burrow systems after each ploughing event. Foraging success of curlew was also greater in sown grassland than in tillage; the number of earthworms caught in the pre-breeding period was significantly higher than the breeding period and was favoured more than any other prey, reflecting the importance of this foraging resource during the pre-breeding period. The research acknowledged that the most important habitat for curlew in modern farmland was sown grassland, with curlew density positively correlated to the proportion of grassland in farmland.
Key findings	Sown grassland provides more productive foraging habitat for curlew than arable tillage, due to the retention of burrow systems which increases rate at which earth worms are caught by foraging curlew
Bertoncelj, I <i>et al.</i> (2025). Positive Effects of Reduced Tillage Practices on Earthworm Population Detected in the Early Transition Period.	Less intensive tilling practices are increasingly adopted globally and have shown to have positive effects on earthworm populations over time. Reduced tillage events were shown to increase both earthworm biomass and abundance. No till practices showed the lowest variability in earthworm populations. Though it is recognised in this study that climatic factors may influence these results.

Key findings	Low intensity conservation tillage or no tillage practices help to maintain earthworm biomass and abundance.
Woodward, D.I. (2022). Assessing drivers of winter abundance change in Eurasian Curlews <i>Numenius arquata</i> in England and Wales. Bird Study, Volume 68, pp 289 – 301.	Grassland cover represents an important winter habitat for curlew and its availability may potentially benefit buffering against depletion of intertidal food resources through the winter period.
Key findings	Grassland cover in the winter is an important foraging habitat for over-wintering curlew.
Onrust, J. (1989). Earth, worms & birds. Groningen Institute for Evolutionary Sciences (GELIFES), University of Groningen, The Netherlands. Chapter 1.	Most organisms cannot cope with agricultural intensification; however, it does not appear to harm earthworm densities. The research cited that some of the most earthworm-rich grasslands in Europe are in areas of intensive grassland management. It is suggested here that foraging dynamics for birds is not about how many earthworms (total abundance) are found in the soil, but indeed how many they can catch. The ability for a bird to forage on earthworms depends on their bill strength, ability to probe, earthworm depth and overall soil resistance.
Key findings	Grassland intensification has not limited earthworm densities, and in some studies earthworms on intensive grassland, earthworm density is found to be higher than in natural grassland.
Vickery, A.J <i>et al.</i> (2001). The management of lowland neutral grasslands in Britain: effects of agricultural practices on birds and their food resources. Journal of Applied Ecology, pp 647 – 664.	In coastal areas, during winter, curlew (in coastal areas only), golden plover and lapwing all show preferences for grassland with short swards. Lapwing's often favour a short sward of less than 5 cm during the over-wintering period. Whilst cutting events do lead to insect mortality, this is often short-lived before a recovery.
Key findings	A short grass sward is beneficial for over-wintering waders.
Milsom, T.P <i>et al.</i> (1996). Design of grassland feeding areas for waders during the winter: the relative importance of sward, landscape factors and human disturbance.	Grassland management options may benefit waders which exploit permanent grassland as a feeding habitat during winter. The strongest correlations in the use of a field by waders was the sward height (shorter being preferred) and the degree of field enclosure more than any other factor (such as disturbance). A mowing operation during mid-October was considered to create an attractive sward for waders.
Key findings	Sward height and sight lines were the strongest factors as to the attractiveness of wader foraging grounds over winter.
Grassland grazing management	
Vickery, A.J <i>et al.</i> (2001). The management of lowland neutral grasslands in Britain: effects of agricultural practices on birds and their food resources. Journal of Applied Ecology, pp 647 – 664.	It was found that selective moderate and seasonal grazing (rather than continuous) can result in structurally heterogeneous swards and a greater insect diversity. Soil dwelling invertebrates will be negatively affected by soil compaction through grazing and the extent to which compaction occurs will depend on the stocking density of livestock within the field.
Key findings	Seasonal grazing can increase insect diversity.

Atkinson, P.W. (2004). What factors determine where invertebrate feeding birds forage in dry agricultural grassland? <i>Ibis</i> , Volume 146, pp 1 – 258.	Common waders of grassland in winter (curlew, golden plover and lapwing) typically prefer pasture with short swards. There is a suggestion of a positive relationship between bare earth and accessibility to the soil which is important for waders as a result of the greater ability to detect prey. Dung from livestock also increases prey availability and is easily accessible to birds.
Key findings	Grass sward structure and dung is important for foraging waders, with short swards allowing greater foraging success.
Lovasz, L. <i>et al.</i> (2024). Natural grazing by horses and cattle promotes bird diversity in a restored European alluvial grassland. <i>PeerJ</i> .	Foraging birds in grassland/pasture showed the strongest positive relationship with low intensity grazing by cattle and horses. It was acknowledged that high intensity grazing and the maintenance of a short sward increased food availability, prey visibility and predator detectability for birds. However, overall invertebrate species richness was optimised with low and moderate grazing densities.
Key findings	Low to moderate grazing densities result in greater invertebrate species richness and therefore improved foraging opportunities for birds.
Barzan, R.F., <i>et al.</i> (2021). Livestock grazing constrains bird abundance and species richness: A global meta-analysis.	Intermediate grazing intensity seems appropriate to maintain bird abundance and richness. The study found that high grazing intensity reduced bird species richness. Additionally, reducing livestock and grazing intensity could reduce the negative effect on bird abundance and richness. Moderate grazing intensities appear to have only a minor impact on abundance and richness.
Key findings	Moderate grazing management can lead to greater species richness and abundance of birds.
Disturbance events and their impact on waders and possible solutions	
Author(s)	Summary of reports key findings
Collop, C. <i>et al.</i> (2016), Quantifying wintering waders' responses to disturbance. British Ornithologists Union.	Intertidal areas of the Wash in East Anglia were subject to a study in 2022/2023 on disturbance impacts to over-wintering waders. The study acknowledged that disturbance could impact birds' energy budgets by reducing the amount of time feeding but suggested that survival would only be affected if birds are unable to compensate by moving elsewhere or by increasing their foraging efficiency. Data collected showed that energetic costs as a result of responding to a disturbance event were low relative to the estimates on wader daily energy requirements (less than 0.1%) and the lost feeding opportunity costs were also similarly low. It was considered that birds on the Wash can cope with a 5% reduction in available time for feeding in which the research calculated this to be between 38 – 162 separate disturbance events per day depending on species and tidal stage.
Key findings	Low costs of individual responses to disturbance suggest no significant impact on foraging waders providing that other areas of foraging habitat are available.
Cutts, V <i>et al.</i> (2024). Guidance on reducing disturbance of shorebirds. Conservation Guidance Series No. 14, v10.	Methods to reduce disturbance to waders, included appropriate signage and interpretation boards as well as restrictive access in order to deter human entry during critical breeding and wintering periods.
Key findings	Methods to restrict access can help reduce disturbance events.

Van der Kolk, H <i>et al.</i> (2019). Cumulative energetic costs of military aircraft, recreational disturbance and natural disturbance in roosting shorebirds. <i>Animal Conservation</i> . Volume 23, Issue 4.	This research studied the impacts of larger disturbance-related factors at high tidal cycle such as military and civil aircraft-related noise and disturbance on shorebirds (including curlew). The research indicated that predictability of disturbance could be an important factor in determining individual responses in birds. For example, birds may anticipate a certain level of danger from an object, but when this is different from the norm, the perception of danger may increase, and they will respond accordingly. The research concluded that the energetic responses from disturbance events were low for curlew and other larger waders, except for bar-tailed godwit.
Key findings	The level of disturbance is often associated with predictability for birds. Overall, energetic costs to curlew through disturbance was considered to be low.