

Glassmoor Wind Farm, Cambridgeshire

Post-construction wintering and breeding bird surveys 2006-07 and 2008

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SUMMARY

The Glassmoor wind farm has 8 x 2MW wind turbines, which have been operating since spring 2006. Wintering bird surveys were carried out during November 2006 – April 2007, and breeding bird surveys were carried out during April – June 2007 and April-June 2008 to satisfy a Planning Condition that formed part of Glassmoor wind farm planning approval. These surveys aimed to establish how the birds that winter and breed in the area have been affected by the wind farm.

There was a very low level of winter bird activity in the study area, both in proximity to the wind turbines and in the wider area. There was insufficient bird use of the area to draw any firm conclusion as to the effects of the wind farm. The surveys have confirmed that the site does not support any important wintering bird populations.

The breeding bird community within the main study area in 2007 and 2008 was very similar to that from the pre-construction baseline from 2001. Birds that had been present in close proximity to the wind turbine locations in the baseline year generally at least maintained their populations there after the turbines had been constructed. There were some minor differences between the years (some of which may have been attributable to the additional survey visit carried out in 2007 and 2008) but nothing that suggested there had been any significant displacement of breeding birds by the wind turbines.

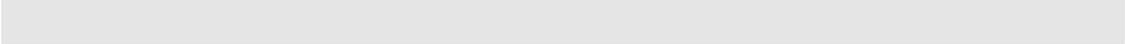
INTRODUCTION

1. Wintering and breeding bird surveys were commissioned by Fenland Windfarms Ltd. to satisfy part of Planning Condition 19 which formed part of the Glassmoor wind farm planning approval. These surveys aimed to establish the birds that winter and breed in the area and those that over-fly the wind farm site.
2. The specific objectives of this work were to:
 - Undertake surveys of the wintering bird populations in and around the wind farm site.
 - Undertake winter vantage point observations to quantify the rates of bird movement across the wind farm site and its surrounds.
 - Undertake surveys of the breeding bird populations in and around the wind farm site;
3. The main part of the analysis was to determine if the wind farm had any displacement effect on the local bird populations. If so, one would expect bird densities to be reduced closer to the turbines. Therefore bird densities have been compared (a) in relation to the distance from the wind turbines, and (b) for the breeding birds, for which there are pre-construction data available, in relation to their baseline distribution. No pre-construction wintering bird surveys had been carried out, so it was not possible to make any comparisons with any baseline at that time.

THE STUDY AREAS

4. The Glassmoor wind farm has 8 x 2MW wind turbines, which have been operating since spring 2006. It is located on predominantly arable farmland, 5km south of Whittlesey, in Cambridgeshire. The wintering bird study area was chosen to include all areas within the potential zone of ecological influence of the proposed wind farm. This included the wind farm site itself, plus at least a 1km buffer. This distance was chosen as it exceeds the greatest distance at which wintering birds have been shown to be affected by existing wind farms (Percival 2005). The wintering bird study area covered a total area of 13.9km².
5. The breeding bird study area included the wind farm itself, a 300m buffer around it (300m being the greatest distance at which breeding birds have been shown to be affected by existing wind farms; Percival 2005), plus an additional area adjacent that functions as a reference area to compare changes in bird densities and distribution patterns. The breeding bird study area covered a total area of 5.2km². A previous breeding bird survey of this area

had been carried out in 2001 as part of the baseline studies for the wind farm Environmental Impact Assessment.

6. The study area is dominated by arable crops (including winter-sown cereals, sugar beet, brassicas, potatoes and rotational set-aside). The field boundaries included typical marginal vegetation, numerous wet ditches, a few small copses, scattered bushes and trees. Most of the ditches are cleared regularly for drainage purposes. There is no open standing water within the study area.
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Wintering 'Non-breeding' Bird Survey 2006-07

Wintering Bird Survey Methods

7. The surveys comprised (a) a field survey based on a simple 'look-see' method, counting the bird numbers within a pre-defined study area (Gilbert et al. 1998), and (b) a vantage point survey, monitoring bird flight activity to quantify movement rates across the study area. The latter focussed on the area in proximity to the wind turbines, and included daytime movements and dawn/dusk roost flights.
8. **Field counts:** this survey work comprised monthly counts of the birds within the wintering bird study area. A total of 6 of these surveys were carried out during early November 2006 – early April 2007. The counts were carried out as instantaneous counts, recording a snapshot of the birds present in each field at the time it was surveyed. One such count of each field was made each survey day, recording the numbers of all the key species present. Any additional records made outside this time were noted as supplementary records. These snapshot counts were organised to ensure that the full range of times of day were covered in each part of the study area. The following species were recorded:
 - All ducks, geese, swans, cormorants, herons, coot and grebes;
 - All waders (including lapwing and golden plover);
 - All birds of prey and owls;
 - Large flocks (>100 birds) of other species (except woodpigeon and rook);
 - Any other notable species.
9. As well as counting each species, the behaviour of each flock was also recorded, e.g. feeding/roosting. Birds in flight over-flying the field during the snapshot were also recorded, together with an estimate their height and direction.
10. **Vantage point surveys:** these were carried out to quantify the numbers that could be at risk of collision with the wind turbines, or that may be disrupted by the presence of the wind farm. A single vantage point was selected to observe bird movements through the wind farm and its surrounds (at TL 286920). The flight observation methodology followed a standard developed in the USA for wind farm assessments (Anderson et al. 1999) and comprised 30-minute fixed point observations from these vantage points. All the key species (see above) were mapped and the flight height of each flock recorded (estimated as accurately as possible using reference structures such as

pylons). The activity during each flight (e.g. flying to roost, foraging) was also recorded. Particular attention was paid to any observations of birds at rotor height crossing the proposed wind farm site that would be at risk of collision. A total of 3 hours vantage point observations were carried out during each site visit (6 x 30-minute observations; 18 hours in total), with the timing of these observations made to cover dawn/dusk roost flights as well as general daytime movements.

11. **Habitat/crop mapping:** mapping of the habitats and crop types available in the study area was carried out during the first visit, so that habitat availability could be determined.
12. **Weather:** weather conditions during all observations were recorded, and visits were made to cover a representative range of visibilities, wind speeds and directions (though avoiding extreme conditions where visibility is severely limited (i.e. fog, continuous heavy rain)).
13. If any important bird populations had been identified during the surveys, then additional nocturnal visits would have been carried out to determine bird activity at night. However no such populations were found, so this additional work was not required.

Wintering Bird Survey Results

Study Area Wintering Bird Total Counts and Conservation Importance

14. The wintering bird populations recorded within the study area during the field surveys in early November 2006 – early April 2007 are summarised in Table 1. The counts recorded during each survey visit are given in Table 2. This gives the raw count total for each species made during the field/sector counts during each visit.

Table 1. Wintering bird populations recorded in the study area field counts during early November 2006 – early April 2007 (n=6 surveys)

Species	Mean count	Peak count	Frequency of occurrence
Little Grebe	0.5	1	50%
Grey Heron	0.3	1	33%
Mute Swan	5.3	15	67%
Mallard	8.3	33	83%
Sparrowhawk	0.3	1	33%
Buzzard	0.2	1	17%
Kestrel	1.8	3	83%
Moorhen	0.3	2	17%
Coot	2.0	7	50%
Golden Plover	4.5	27	17%
Lapwing	0.7	3	33%
Black-headed Gull	4.2	16	67%

Species	Mean count	Peak count	Frequency of occurrence
Common Gull	3.2	10	83%

Table 2. Wintering bird populations in the Glassmoor wintering bird study area, 2006-07: field count totals for each visit. *Note: the table includes all waterfowl and birds of prey, plus other abundant species (occurring in >100 individuals) and species of conservation importance.*

Species	09/11/2006	04/12/2006	04/01/2007	08/02/2007	08/03/2007	12/04/2007
Little Grebe	0	0	0	1	1	1
Grey Heron	1	0	0	1	0	0
Mute Swan	0	2	7	15	8	0
Mallard	2	2	0	33	6	7
Sparrowhawk	0	0	1	0	0	1
Buzzard	0	0	0	1	0	0
Kestrel	3	3	0	1	2	2
Moorhen	0	0	0	0	0	2
Coot	0	0	0	7	2	3
Golden Plover	0	0	0	27	0	0
Lapwing	3	0	0	0	0	1
Black-headed Gull	2	0	2	16	0	5
Common Gull	5	1	10	0	2	1

Bird Flight Rates over the Wind Farm Site

15. The observed bird flight rates over the wind farm site are summarised in Table 3, which gives the mean over-flying rate per hour over the November 2006 – April 2007 study period. This includes all the observations of birds (of the species noted in the methods section above) flying over the proposed wind farm site and its surrounds. No species was observed over-flying in particularly important numbers and no important regularly used flight lines were noted. Table 4 gives the over-flying totals observed during each survey visit. The Table also gives the percentage of flights of each species that were recorded at rotor height.

Table 3. Bird flight rates recorded over the wintering bird study area during November 2006 – April 2007 vantage point surveys. N = 18 hours total observation from the one vantage point.

Species	Flight rate (no/hr)	Total no. of flights recorded	% at rotor height
Cormorant	0.4	7	29%
Grey Heron	0.3	6	33%
Mute Swan	0.4	8	0%
Bewick's Swan	1.0	18	50%
Mallard	3.4	62	0%
Tufted Duck	0.3	6	0%

Species	Flight rate (no/hr)	Total no. of flights recorded	% at rotor height
Marsh Harrier	0.1	1	0%
Buzzard	0.1	1	0%
Kestrel	1.1	20	0%
Merlin	0.1	1	0
Peregrine	0.1	1	100%
Golden Plover	5.7	102	34%
Lapwing	0.1	2	0%
Black-headed Gull	4.2	76	4%
Common Gull	3.7	66	9%
Lesser Black-backed Gull	0.4	7	43%
Herring Gull	0.1	2	100%
Great Black-backed Gull	0.1	1	0%

Table 4. Wintering bird over-flying counts through the Glassmoor wintering bird study area, 2006-07: vantage point totals for each visit (3 hours per visit).

Note: the table includes all waterfowl and birds of prey, plus other abundant species (occurring in >100 individuals) and species of conservation importance.

Species	09/11/2006	04/12/2006	04/01/2007	08/02/2007	08/03/2007	12/04/2007
Cormorant	0	1	0	3	0	3
Grey Heron	1	1	0	1	1	2
Mute Swan	0	0	3	0	5	0
Bewick's Swan	9	0	0	0	9	0
Mallard	4	0	0	47	4	7
Tufted Duck	0	0	0	2	4	0
Marsh Harrier	0	0	0	0	1	0
Buzzard	0	0	0	1	0	0
Kestrel	3	2	6	3	2	4
Merlin	0	0	0	1	0	0
Peregrine	0	1	0	0	0	0
Golden Plover	28	0	26	14	0	34
Lapwing	0	0	0	0	0	2
Black-headed Gull	3	20	2	4	9	38
Common Gull	12	10	36	0	7	1
Lesser Black-backed Gull	0	0	5	0	0	2
Herring Gull	0	0	1	0	1	0
Great Black-backed Gull	1	0	0	0	0	0

Habitats/crop availability within the study area

- The study area was predominantly arable farmland. The areas of each of the main crop/habitat types is summarised in Table 5. Winter cereals and plough were the more widespread.

Table 5. Areas of crop/habitat types within the wintering bird study area, November 2006.

Crop/habitat	Area in Nov 2006 (ha.)	% of study area
Winter cereal	550	41%
Plough	628	47%
Rape	73	5.4%
Stubble	20	1.5%
Improved grassland	12	0.9%
Farm reservoir	4	0.3%
Set aside	38	2.8%
Rough grassland	8	0.6%
Scrub	2	0.1%
Parsnips	12	0.9%

Conservation Evaluation of Wintering Bird Populations

17. No previous wintering bird surveys of this area have been undertaken or presented in the ES, so an evaluation of the importance of the wintering bird populations has been carried out and is presented here.
18. The sensitivity of the non-breeding bird populations was determined using the criteria specified in Table 6. This includes the criteria adopted by English Nature in Guidelines for Selection of Biological SSSIs (JNCC 1995), using 1% of the resource to define national and regional importance (Baker et al. 2006, Clark 2006). A further category of 'local importance' was used for species that did not reach regional importance but were still of some ecological value. For bird species this included all species on the red or amber lists of the RSPB' *et al's* (2002) 'Birds of Conservation Concern' that did not reach national or regional importance at the site. In addition listing on Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside, UK Biodiversity Action Plan [BAP] priority species and local BAP species were all considered in the evaluation process.

Table 6. Definition of terms relating to the sensitivity of the ecological components of the site.

Sensitivity	Definition
VERY HIGH	Cited interest of SPAs, SACs and SSSIs. Cited means mentioned in the citation text for the site as a species for which the site is designated (SPAs/SACs) or notified (SSSIs).
HIGH	Other species that contribute to the integrity of an SPA or SSSI. A local population of more than 1% of the national population of a species. EU Birds Directive Annex 1, EU Habitats Directive priority habitat/species and/or W&C Act Schedule 1 species. Ecologically sensitive species, e.g. large birds of prey or rare birds (<300 breeding pairs in the UK).
MEDIUM	Regionally important population of a species, either because of population size or distributional context. UK BAP priority species (if not covered above).
LOW	Any other species of conservation interest, e.g. species listed on the Birds of Conservation Concern not covered above. Local BAP species (if not covered above).

19. The conservation value of the non-breeding bird populations observed at Glassmoor has been summarised in Table 7. This included one species classed as very high sensitivity, Bewick's swan, through its inclusion as a Nene Washes SPA qualifying interest species, four high sensitivity species (through their listing on Annex 1 of the Birds Directive and/or Schedule 1 of the Wildlife and Countryside Act), one medium sensitivity (present in regionally important numbers) and eight low sensitivity species.

Table 7. Conservation evaluation of the wintering bird populations at Glassmoor, 2006-07. Note: Table includes all species of low or higher sensitivity. Italics = over-flying only.

Species	Peak count	SPA qualifying species	>1% regional population	EU Birds Directive Annex 1	W and C Act Schedule 1	Red [R]/ Amber [A] List	UK BAP priority species	Sensitivity
<i>Cormorant</i>	3					A		Low
Mute swan	15					A		Low
<i>Bewick's swan</i>	9	✓		✓		A		V high
Marsh harrier	1			✓	✓	A		High
Buzzard	1		✓					Medium
Kestrel	3					A		Low
Merlin	1			✓	✓	A		High
Peregrine	1			✓	✓	A		High
Golden plover	27			✓				High
Lapwing	3					A		Low
Black-headed gull	16					A		Low
Common gull	10					A		Low
<i>Lesser black-backed gull</i>	5					A		Low
<i>Herring gull</i>	1					A		Low

Distribution of Wintering Bird Populations in relation to the wind turbines

20. The bird numbers/density recorded during the field counts within 600m of the wind turbines is compared with those in the remainder of the study area in Table 8. Generally bird numbers throughout the study area were very low, so it is difficult to make any detailed comparisons. Two small flocks of golden plover (of 13 and 14 birds) were recorded, both within the 600m zone (both about 400m from the turbines and one of these between the two rows of

turbines). However the number of flocks is too low to draw any firm conclusions.

Table 8. *Wintering bird field counts in the Glassmoor study area, 2006-07: mean density and peak counts for the areas within 600m of the wind turbines and the remainder of the study area.*

Species	<600m from turbines		>600m from turbines	
	Mean density (birds/km ²)	Peak count	Mean density (birds/km ²)	Peak count
Little Grebe	0	0	0.05	1
Grey Heron	0	0	0.03	1
Mute Swan	0.08	2	0.52	13
Mallard	0.20	5	0.77	28
Sparrowhawk	0	0	0.03	1
Buzzard	0.04	1	0	0
Kestrel	0.08	1	0.15	2
Moorhen	0	0	0.03	2
Coot	0	0	0.21	7
Golden Plover	1.07	27	0	0
Lapwing	0	0	0.07	3
Black-headed Gull	0	0	0.43	16
Common Gull	0.08	2	0.29	10

Wintering Bird Flight Behaviour in relation to the wind turbines

21. The vantage point surveys recorded a similar very low level of bird activity to the field counts. There were a small number of flights of some very high/high sensitivity species, and these have been plotted on Figures 1 (golden plover) and 2 (all other species). The frequency of flights was too low to determine if the wind turbines had affected any birds' flight behaviour.

Conclusions: effects of the wind farm on wintering birds

22. There was a very low level of winter bird activity in the study area, both in proximity to the wind turbines and in the wider area. There was insufficient bird use of the area to draw any firm conclusion as to the effects of the wind farm.
23. The surveys have confirmed that the site does not support any important wintering bird populations.

BREEDING BIRD SURVEY

Survey Methods

Breeding Bird Surveys

24. The main breeding bird survey was carried out using a standardised timed method, essentially a walkover survey following the methodology of the Common Birds Census (Gilbert *et al.* 1998). The monitoring condition specified that three survey visits should be made (two visits had been undertaken for the ES baseline survey in 2001 on 10 May and 3 June): in 2007 the first was carried out on 30 April, the second on 15 May and the third on 26 June; in 2008 the first was carried out on 16 April, the second on 6 May and the third on 4 June. All bird locations and behaviour were mapped to 1:10,000 scale, using the standard Common Birds Census notation. Supplementary behavioural observations and notes were made to determine breeding locations as accurately as possible. The area was subdivided into half-kilometre square areas. Birds were recorded systematically for 20-25 minutes in each of these areas, standardising the search effort per unit area. The surveys avoided strong winds, heavy rain, fog and low cloud. Birds were located by walking, listening and scanning by eye and with binoculars. Birds were considered to be breeding if singing, displaying, carrying nest material, nests or young found, repetitively alarmed adults, disturbance displaying, carrying food or in territorial dispute. A record in potentially suitable breeding habitat on a single visit was considered sufficient to indicate a potential breeding attempt.
25. The survey data were used to obtain population estimates for all of the bird species breeding on the site. Maps were produced of the breeding pairs recorded during each visit and these were combined to produce an estimate of the overall breeding population for each species. Pairs were considered separate from each other if greater than 1km (waterfowl and raptors), 500m (pigeons, gamebirds and crows) or 200m (all other species) apart, with this distance reflecting the relative distance that birds might move between survey visits.

Survey Results

Breeding Bird Surveys

26. The breeding bird population estimates within the study area are given in Table 9. The Table also gives the results from the previous 2001 surveys (before the wind farm was constructed). Numbers are given for the whole study area, the area within 300m of the turbines (the distance used for the worst-case

disturbance assessment in the Environmental Statement) and the area more than 300m from the turbines.

Table 9. Breeding bird population estimates at Glassmoor, 2007 and 2008, with those for the same area for 2001 (prior to construction of the wind farm) given for comparison.

Species	Study Area			Within turbine 300m zone			Outside turbine 300m zone		
	2001	2007	2008	2001	2007	2008	2001	2007	2008
Mute Swan	1	1	3	1	0	0	0	1	3
Shelduck	0	2	0	0	0	0	0	2	0
Mallard	11	7	24	2	2	3	9	5	21
Tufted Duck	0	0	3	0	0	0	0	0	3
Buzzard	0	0	1	0	0	1	0	0	0
Kestrel	0	2	3	0	0	1	0	2	2
Red-legged Partridge	9	14	17	5	6	6	4	8	11
Grey Partridge	0	2	2	0	0	1	0	2	1
Pheasant	19	25	27	9	9	8	10	16	19
Moorhen	0	3	4	0	0	1	0	3	3
Lapwing	0	1	1	0	0	0	0	1	1
Stock Dove	12	24	17	3	18	4	9	6	13
Woodpigeon	229	39	28	182	18	14	47	21	14
Collared Dove	0	1	1	0	0	1	0	1	0
Skylark	66	113	88	29	34	22	37	79	66
Swallow	0	0	2	0	0	0	0	0	2
Meadow Pipit	11	14	35	5	2	8	6	12	27
Yellow Wagtail	22	45	45	10	16	18	12	29	27
Pied Wagtail	1	4	5	0	3	4	1	1	1
Wren	4	3	12	1	1	4	3	2	8
Dunnock	0	1	2	0	1	0	0	0	2
Blackbird	1	3	5	1	0	3	0	3	2
Mistle Thrush	0	1	0	0	0	0	0	1	0
Sedge Warbler	2	15	14	1	1	4	1	14	10
Reed Warbler	5	25	21	2	6	6	3	19	15
Whitethroat	3	6	5	1	5	2	2	1	3
Blue Tit	1	0	0	1	0	0	0	0	0
Magpie	2	3	1	1	1	0	1	2	1
Carrion Crow	4	4	5	1	0	1	3	4	4
Starling	0	1	0	0	0	0	0	1	0
Chaffinch	0	8	3	0	5	1	0	3	2
Greenfinch	0	2	0	0	0	0	0	2	0
Goldfinch	3	2	0	3	0	0	0	2	0
Linnet	20	14	21	19	4	13	1	10	8
Yellowhammer	1	0	1	0	0	0	1	0	1
Reed Bunting	12	37	40	7	8	13	5	29	27
Corn Bunting	4	10	7	3	2	4	1	8	3

27. The breeding bird populations within the study area were broadly similar in 2001, 2007 and 2008, with higher numbers of some species (notably woodpigeon) in 2001 but higher numbers of several others (including stock

dove, skylark, yellow wagtail, sedge and reed warblers, chaffinch and reed and corn bunting) in 2007 and 2008. The higher numbers recorded in 2007 and 2008 may have been at least partly attributable to the additional survey visit carried out in those years. The area within 300m of the wind turbines has continued to support a similar breeding bird community to that it held prior to construction, with lower numbers of some species (including woodpigeon and, in 2008, skylark) but higher numbers of others (including yellow wagtail and reed bunting). The distributions of the breeding birds within the study area are shown in Figures 3 to 16, with the maps for the pre-construction and post-construction years presented side by side for comparison. The more abundant species have been presented separately for clarity.

28. The distributions of the more abundant breeding birds (those with a sufficient population size to give a meaningful results, taken as those with at least 7 independent locations in both years being compared) in relation to the wind turbines were investigated further by analysing the distance from each breeding pair location to the nearest turbine location before and after construction. If any of these birds were avoiding the turbines, then one would expect a greater distance from the turbines in 2007 and 2008 after that had been constructed. The results of these analyses are summarised in Table 10, which gives the mean distance to the nearest turbines for each species for the three years. Table 11 gives the results of the statistical (t-test) analysis of these data, with a null hypothesis of no difference between the pre-construction (2001) and post-construction years (2007 and 2008). The t-statistic from the t-test analysis, the degrees of freedom (a measure of the sample size) and the probability associated with the test are given. A probability of less than 0.05 would be required to reject the null hypothesis. In both 2007 and 2008 all of these species showed no statistically significant difference in the mean distance to the nearest turbine compared with the pre-construction baseline (2001).

Table 10. Mean distance of breeding birds at Glassmoor from the wind turbines in 2007 and 2008 (\pm standard error), with those for the same area for 2001 (prior to construction of the wind farm) given for comparison.

Species	Mean distance to nearest turbine (m)		
	2001	2007	2008
Skylark	418 (41)	481 (27)	473 (26)
Meadow Pipit	391 (86)	531 (75)	537 (49)
Yellow Wagtail	386 (65)	454 (43)	372 (38)
Reed Bunting	329 (89)	492 (45)	455 (49)

Table 11. Statistical analysis of distances of breeding birds from wind turbines before and after construction.

Species	2001 v 2007			2001 v 2008		
	t-statistic	Degrees of freedom	Probability	t-statistic	Degrees of freedom	Probability
Skylark	-1.3	119	0.20	-1.1	113	0.26
Meadow Pipit	-1.2	20	0.26	-1.4	16	0.18
Yellow Wagtail	-0.9	39	0.39	0.2	35	0.85
Reed Bunting	-1.6	16	0.12	-1.2	18	0.23

29. The distributions of these four species (skylark, meadow pipit, yellow wagtail and reed bunting) in relation to the distance from the wind turbines are summarised in Figures 17 to 20 respectively. Skylark (Figure 17) distribution was similar in the three years, though with higher total numbers in 2007 and 2008 over the 2001 baseline. Meadow pipits (Figure 18) were recorded in similar numbers and distribution between the three years apart from an increase in the 600m and >600m zones in 2007 and 2008. Yellow wagtail (Figure 19) has a similar distribution in all three years, though with an increase in numbers over most of the zones (including within 100m of the turbines). Reed buntings were recorded in increased numbers in 2007 and 2008, though were not recorded in the 100m zone in close proximity to the turbines in 2008 (Figure 20).
30. No evidence has been found from the 2007 and 2008 survey data of any statistically significant effects on the local breeding bird populations that is likely to be linked to the presence of the wind farm. There has not been any major change in the breeding bird community, and no significant population reduction through displacement. The results of the two year's post-construction monitoring suggest that the local breeding bird community has been largely unaffected by the wind turbines. It is certainly very clear that the worst-case assumption made in the ES, that birds would be displaced to 300m from the turbines, was not a reasonable worst-case and that the actual effects were much less than this.

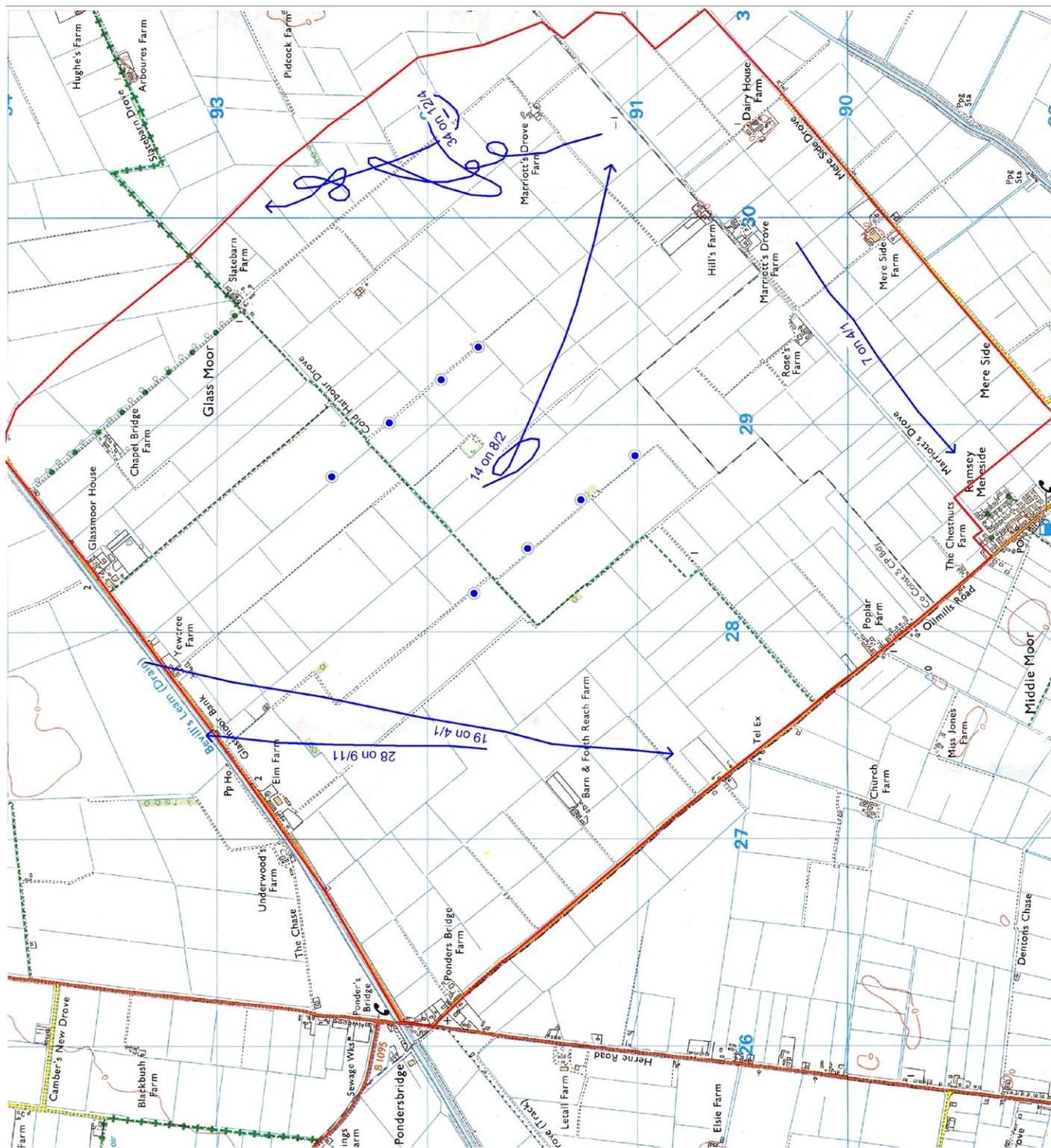
Conclusions: effects of the wind farm on breeding birds

31. The 2007 and 2008 data showed no statistically significant effects on the breeding bird populations in comparison with those from the 2001 pre-construction baseline. Birds that had been present in proximity to the wind turbine locations in the baseline year generally at least maintained their populations there after the turbines had been constructed.
32. Overall, there were some minor differences between breeding bird populations recorded in the pre-construction baseline and in the post-construction surveys, but nothing that suggested there had been any significant displacement of breeding birds from around the wind turbines.

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Figure 1. Golden plover winter flight lines 2006-07



KEY:

- Winter bird study area
- ↑ Golden plover flight line (flock & date)
- Wind turbine

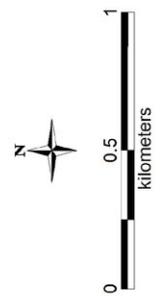
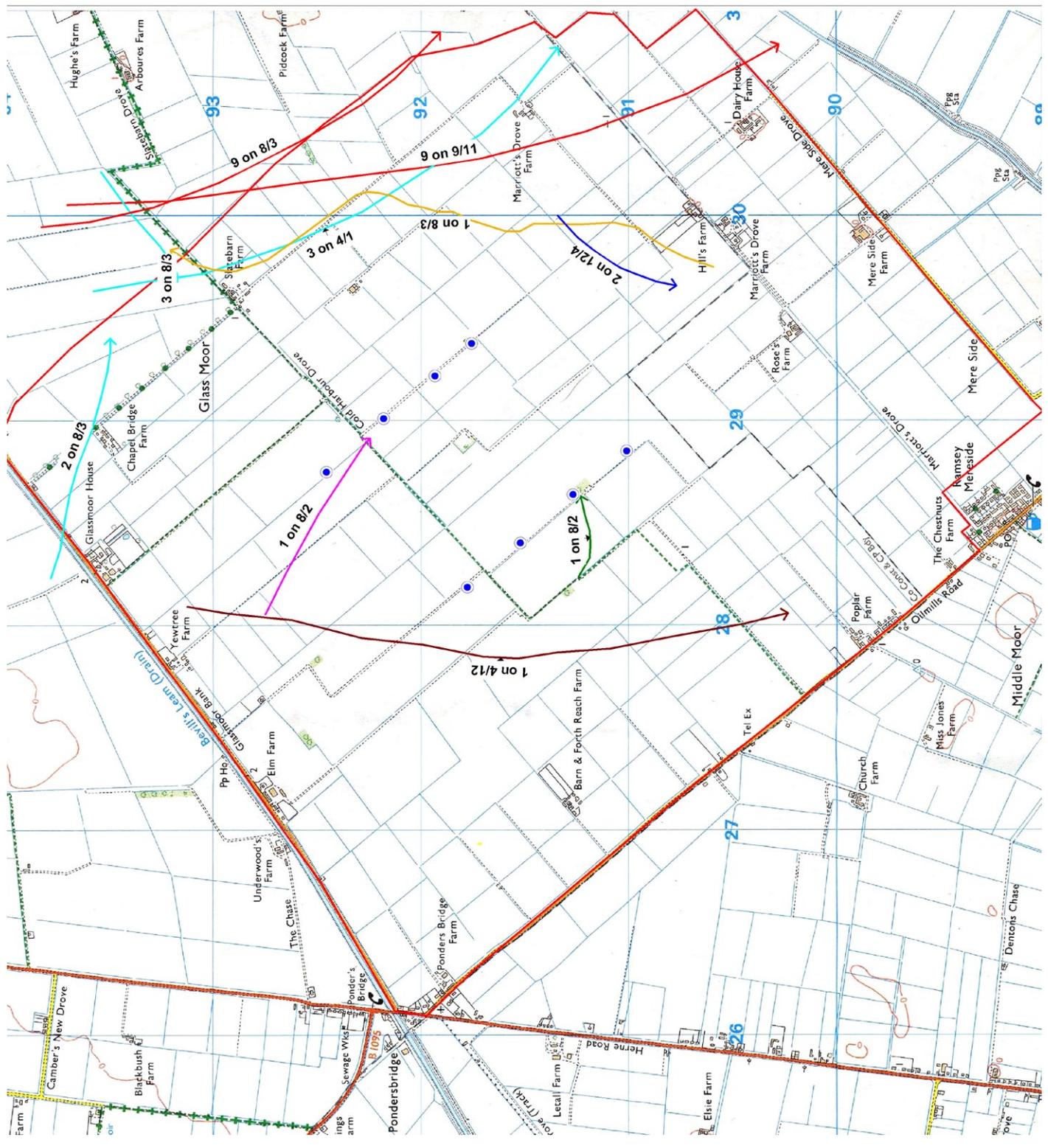
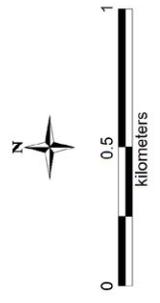
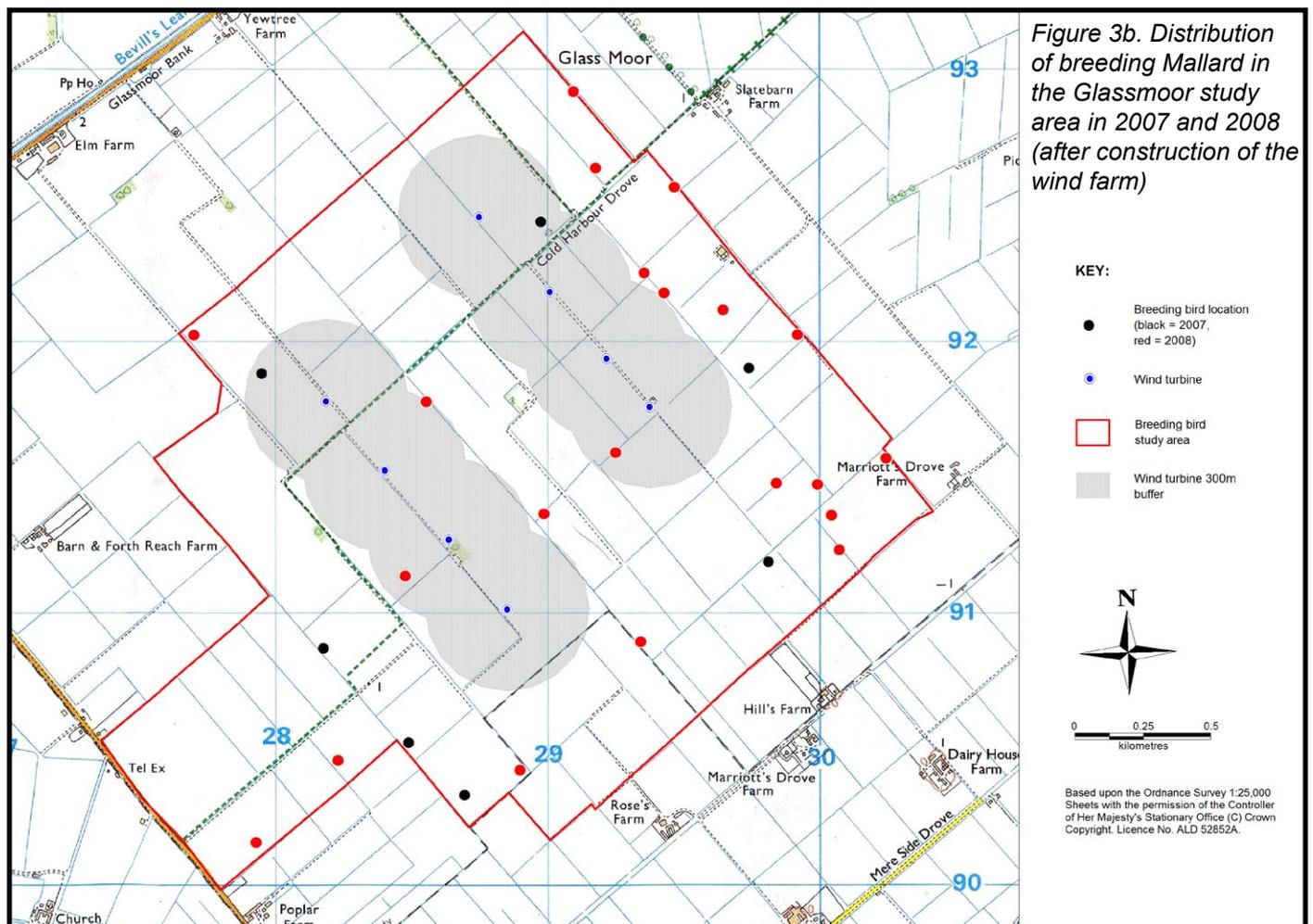
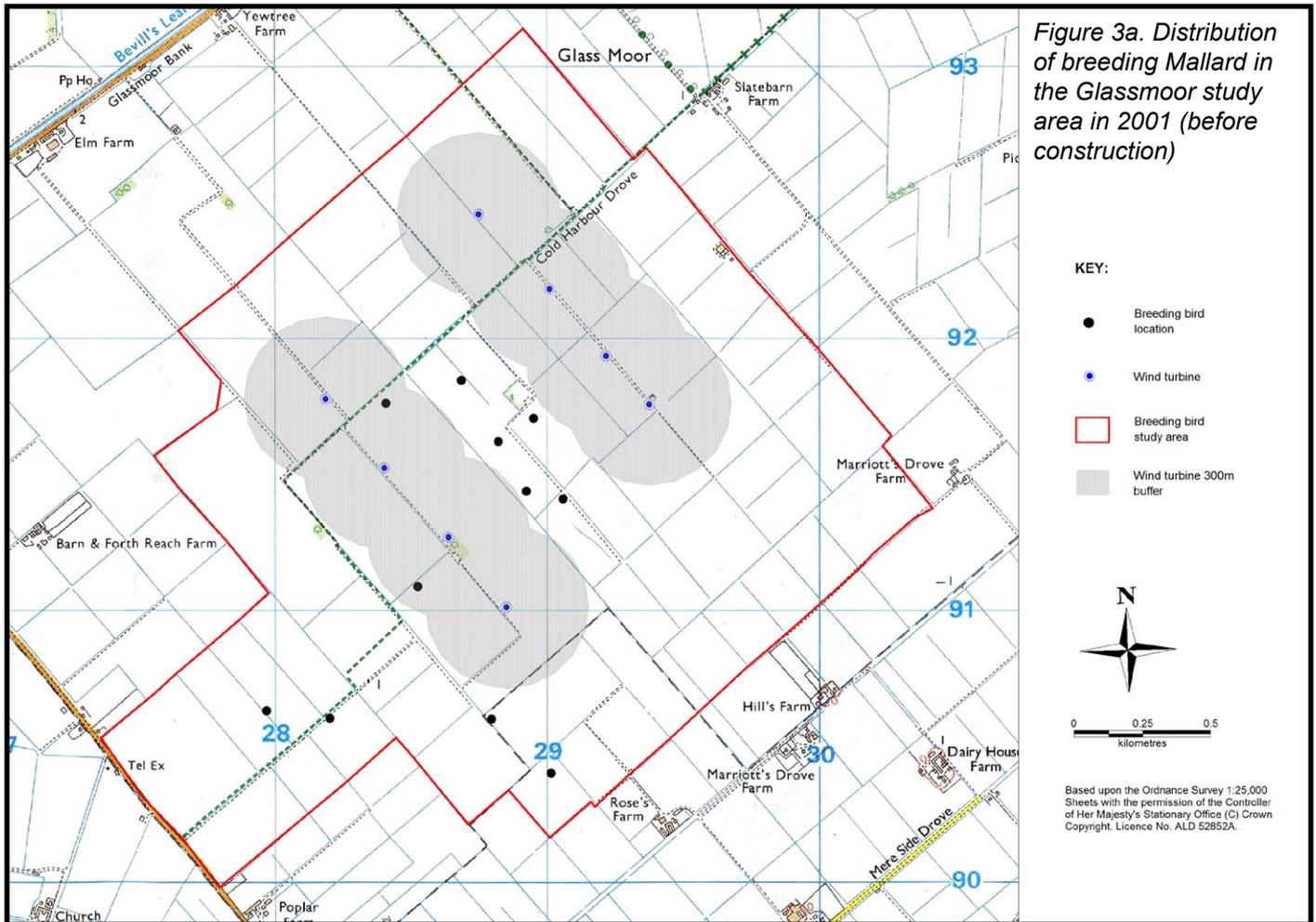


Figure 2. Other species winter flight lines 2006-07



- KEY:
- Flight lines:
- Bewick's swan
 - Mute swan
 - Buzzard
 - Marsh harrier
 - Peregrine
 - Merlin
 - Lapwing
 - (nos = flock & date)
 - Winter bird study area
 - Wind turbine





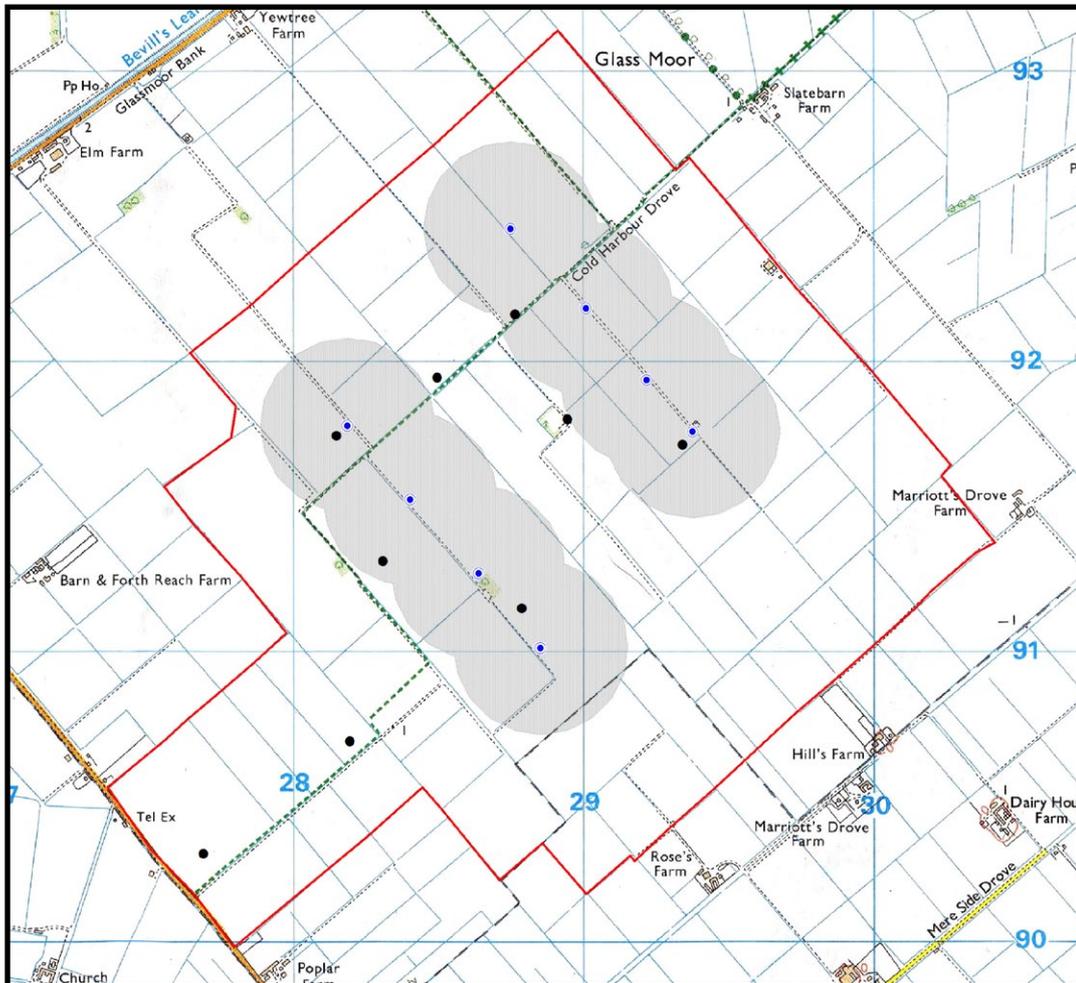
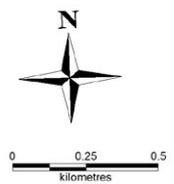


Figure 4a. Distribution of breeding Red-legged Partridge in the Glassmoor study area in 2001 (before construction)

KEY:

- Breeding bird location
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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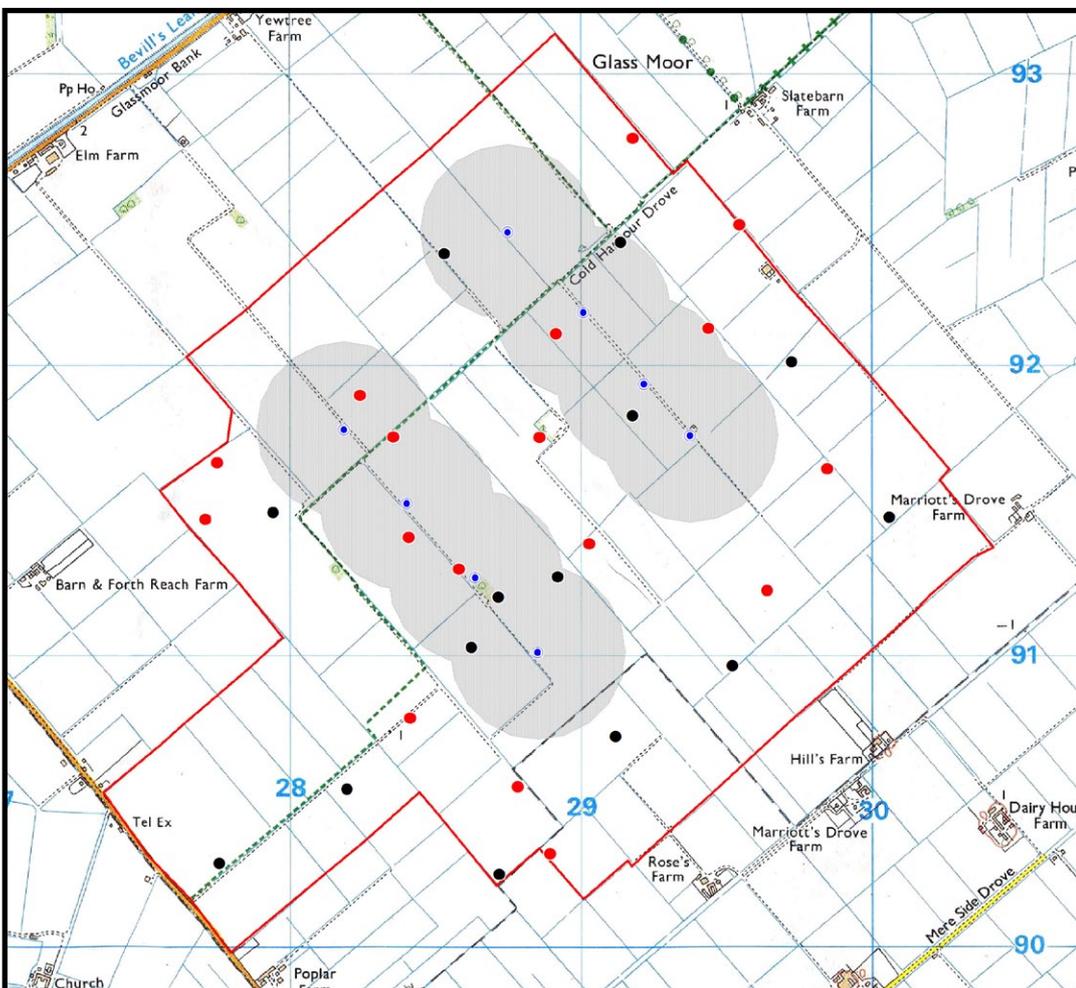
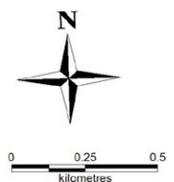


Figure 4b. Distribution of breeding Red-legged Partridge in the Glassmoor study area in 2007 and 2008 (after construction of the wind farm)

KEY:

- Breeding bird location (black = 2007, red = 2008)
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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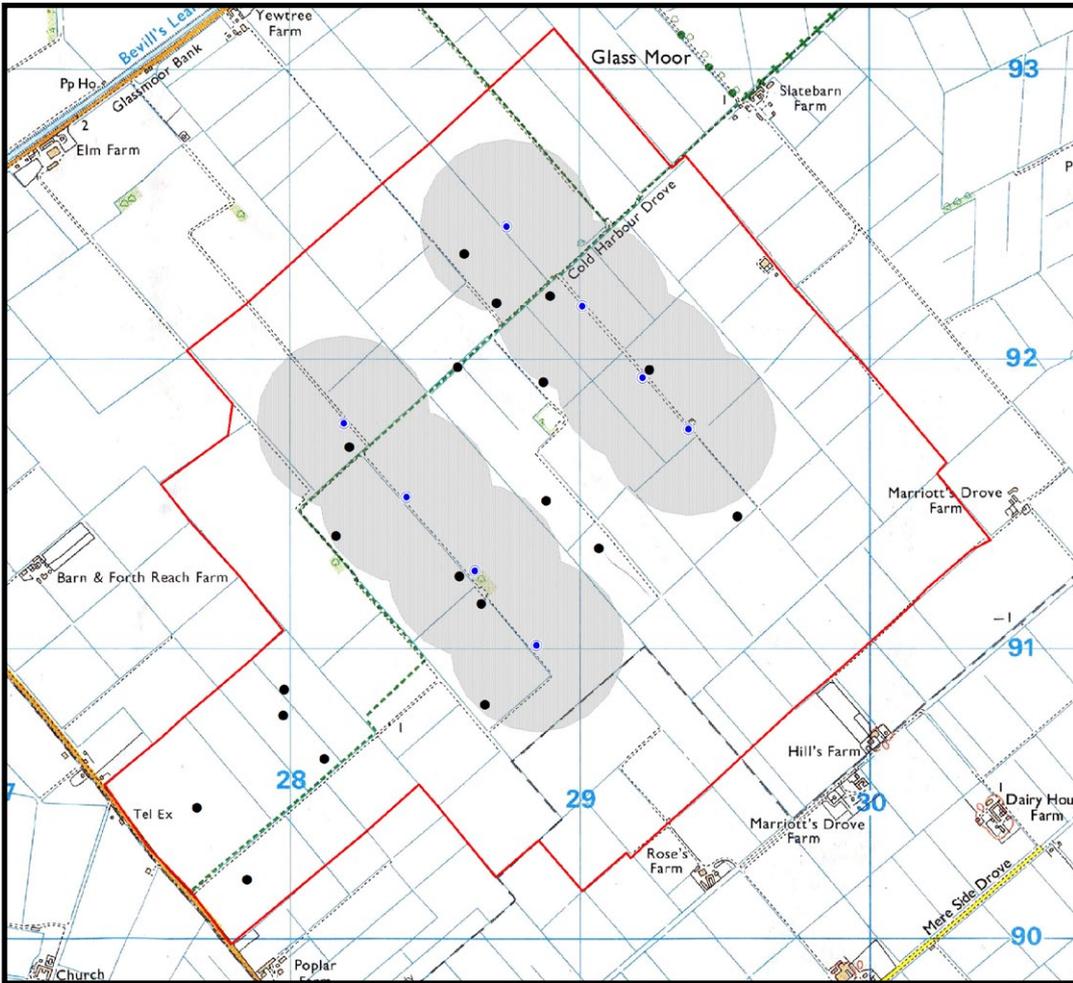
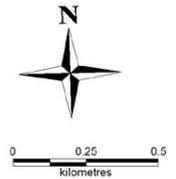


Figure 5a. Distribution of breeding Pheasant in the Glassmoor study area in 2001 (before construction)

- KEY:
- Breeding bird location
 - Wind turbine
 - Breeding bird study area
 - Wind turbine 300m buffer



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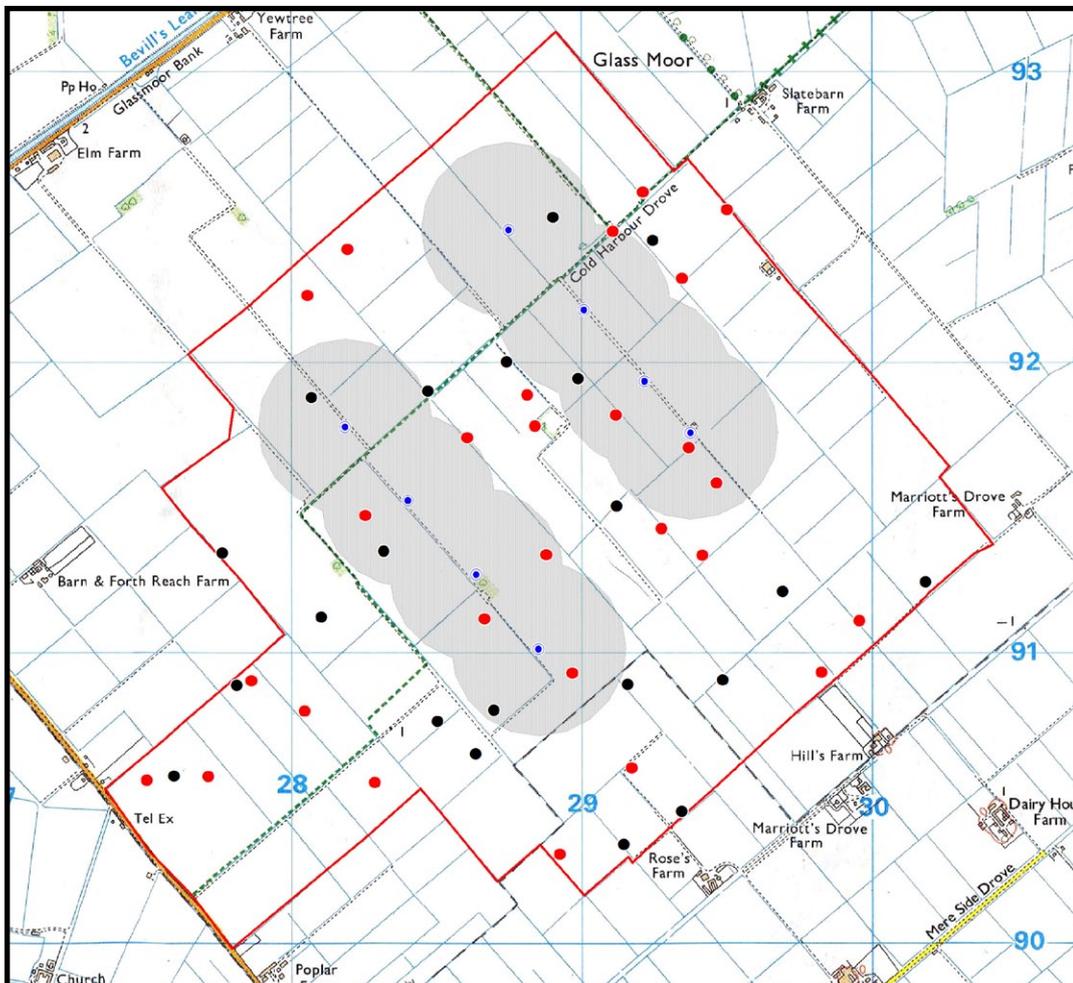
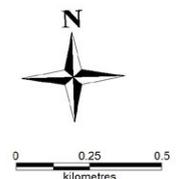


Figure 5b. Distribution of breeding Pheasant in the Glassmoor study area in 2007 and 2008 (after construction of the wind farm)

- KEY:
- Breeding bird location (black = 2007, red = 2008)
 - Wind turbine
 - Breeding bird study area
 - Wind turbine 300m buffer



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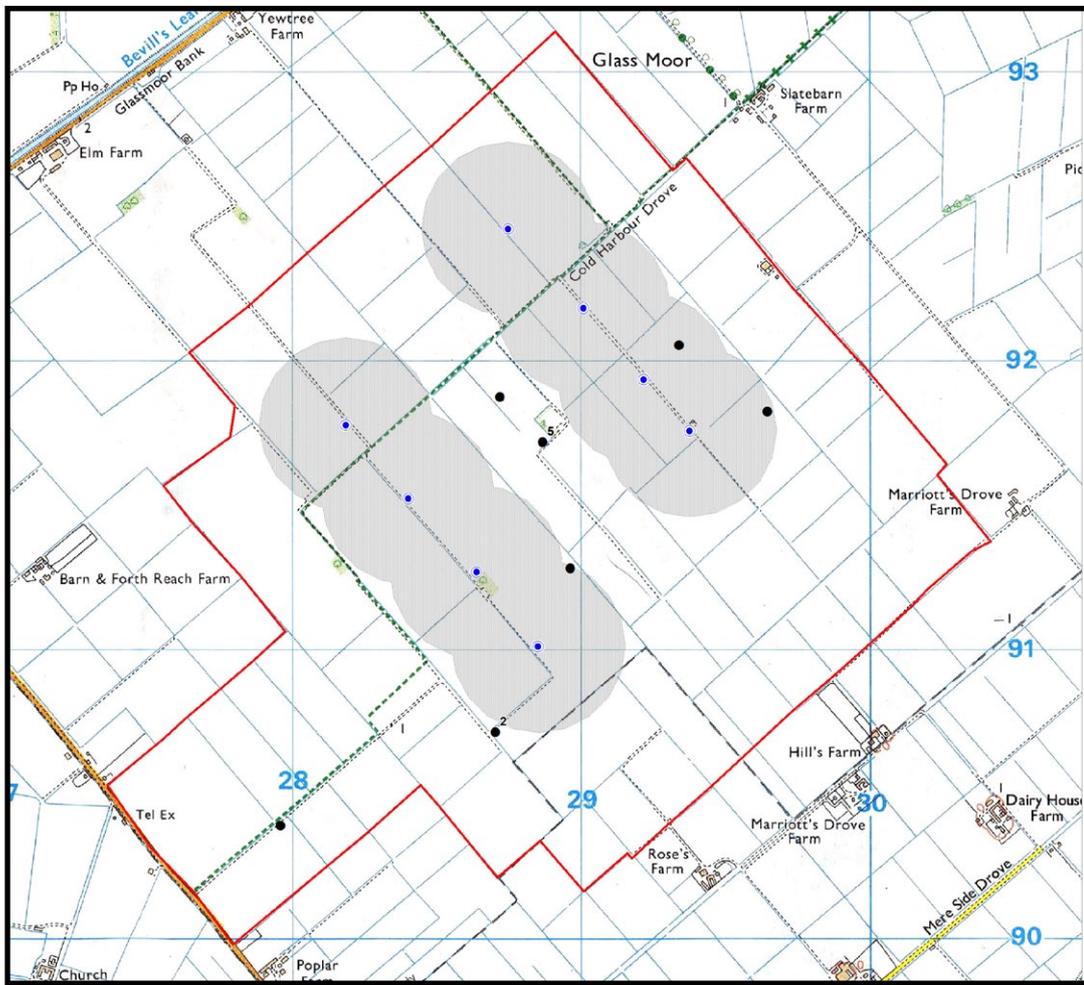
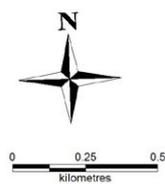


Figure 6a. Distribution of breeding Stock Dove in the Glassmoor study area in 2001 (before construction)

KEY:

- Breeding bird location
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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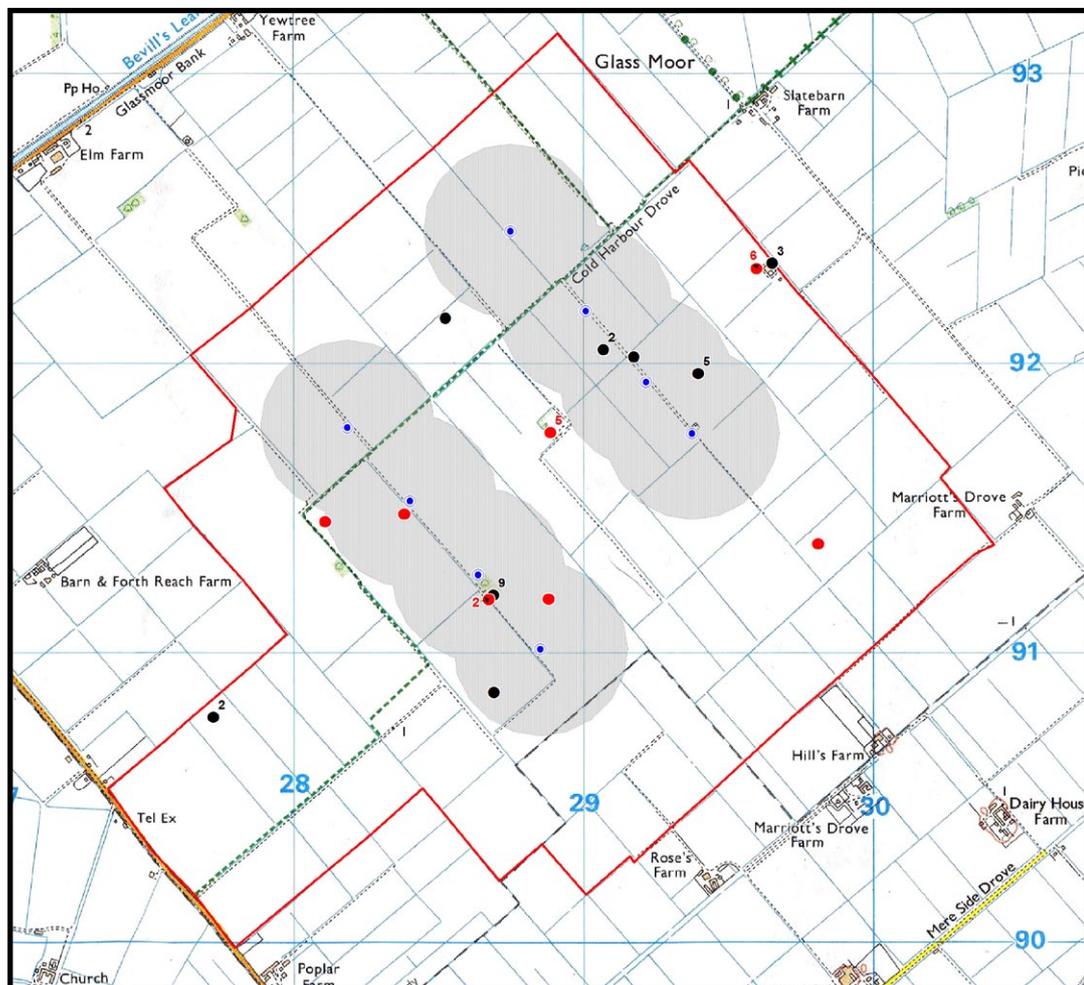
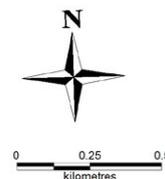


Figure 6b. Distribution of breeding Stock Dove in the Glassmoor study area in 2007 and 2008 (after construction of the wind farm)

KEY:

- Breeding bird location (black = 2007, red = 2008)
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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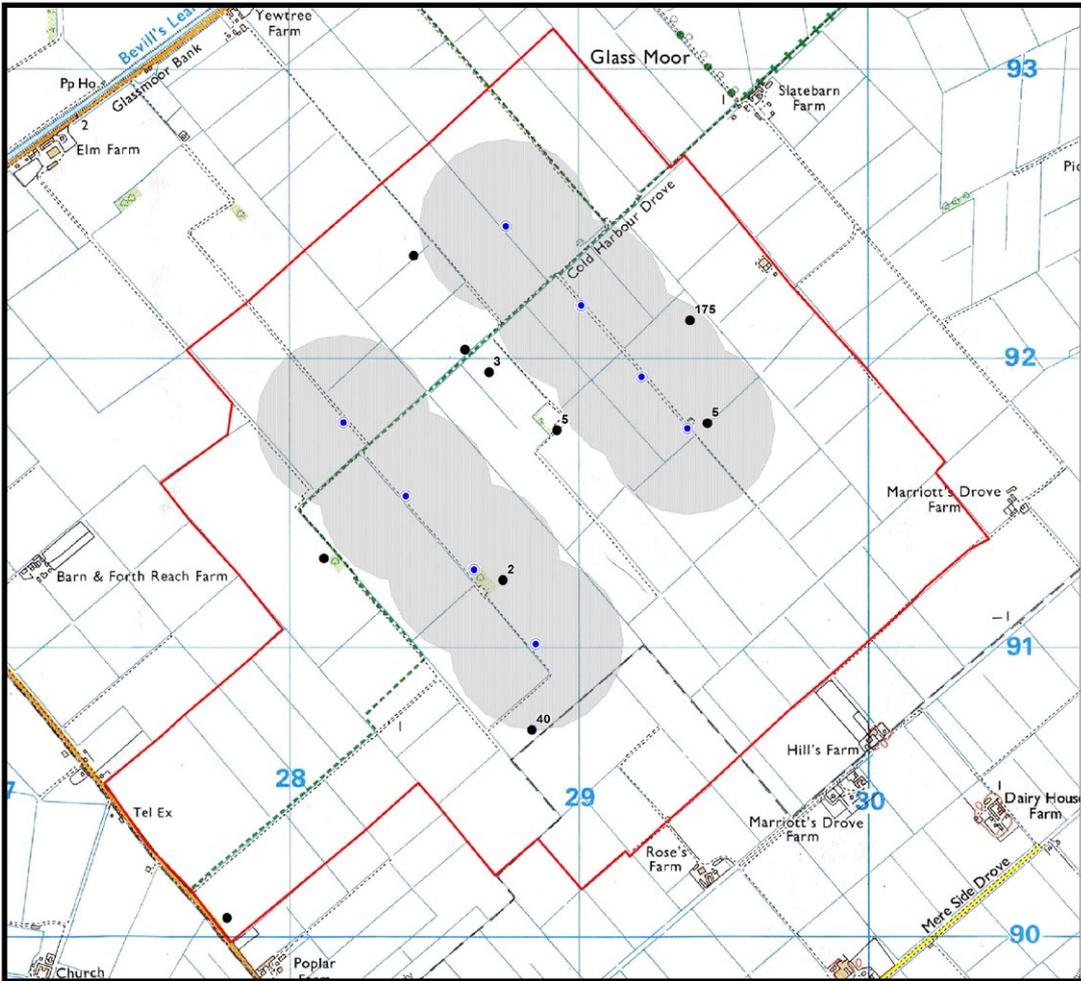
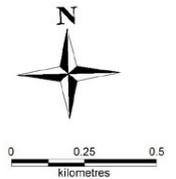


Figure 7a. Distribution of breeding Woodpigeon in the Glassmoor study area in 2001 (before construction)

- KEY:
- Breeding bird location
 - Wind turbine
 - Breeding bird study area
 - Wind turbine 300m buffer



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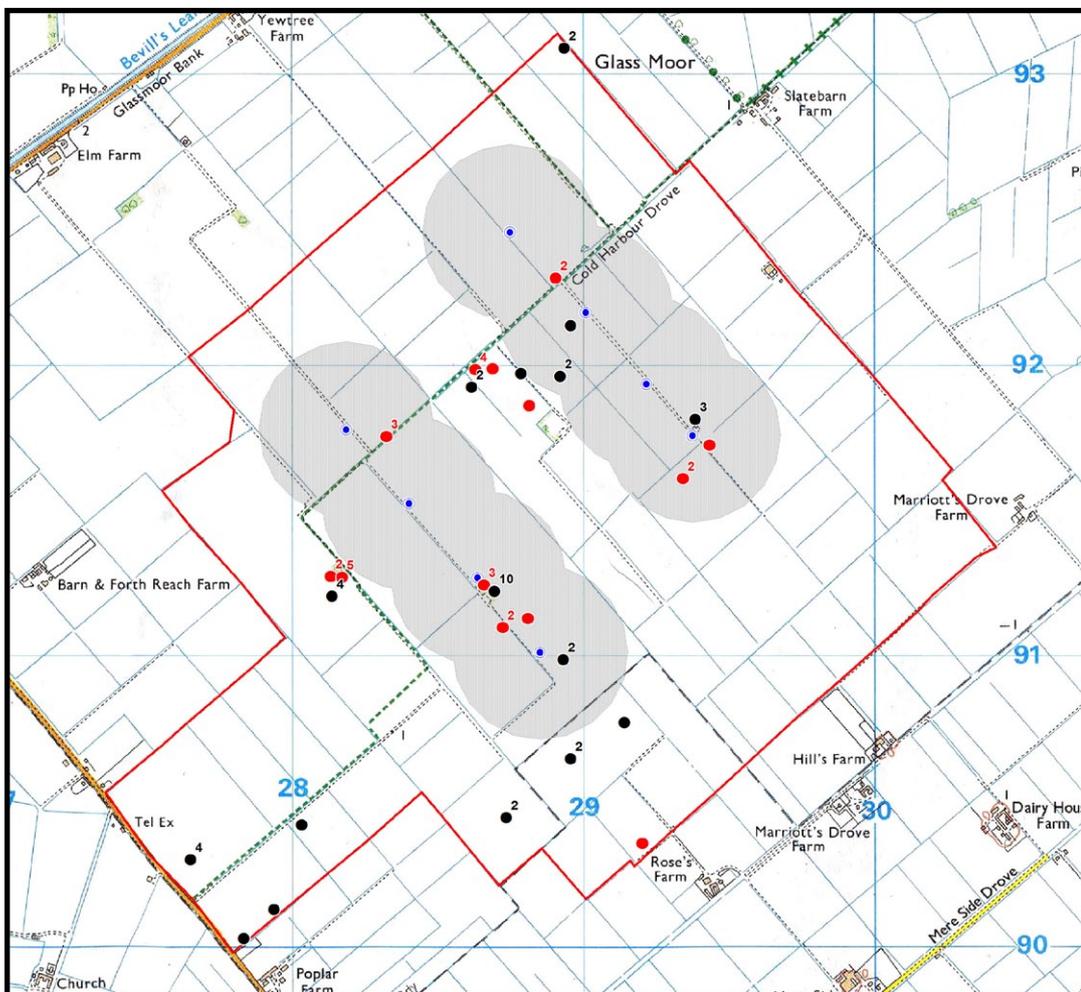
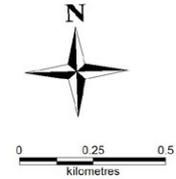


Figure 7b. Distribution of breeding Woodpigeon in the Glassmoor study area in 2007 and 2008 (after construction of the wind farm)

- KEY:
- Breeding bird location (black = 2007, red = 2008)
 - Wind turbine
 - Breeding bird study area
 - Wind turbine 300m buffer



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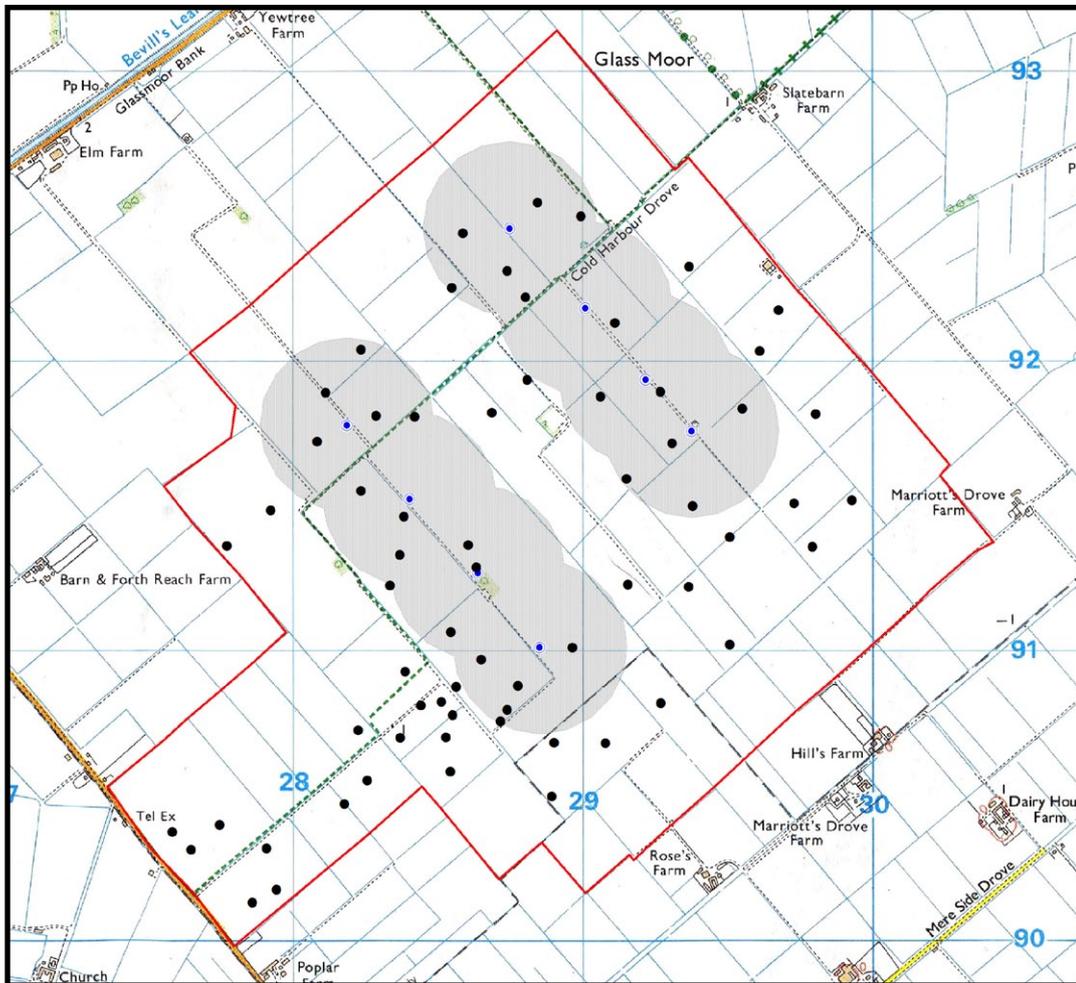
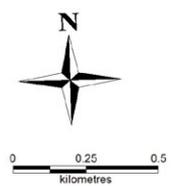


Figure 8a. Distribution of breeding Skylark in the Glassmoor study area in 2001 (before construction)

KEY:

- Breeding bird location
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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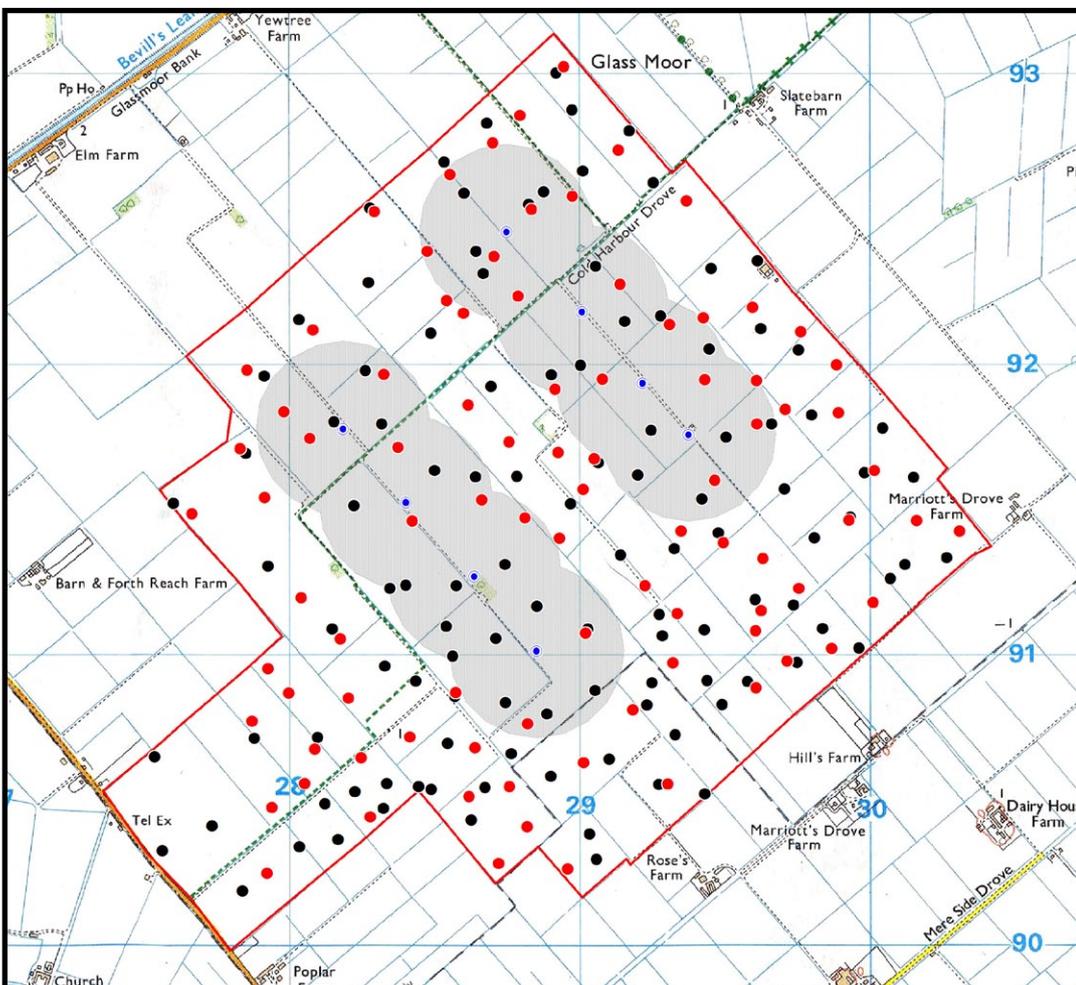
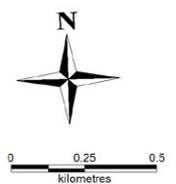


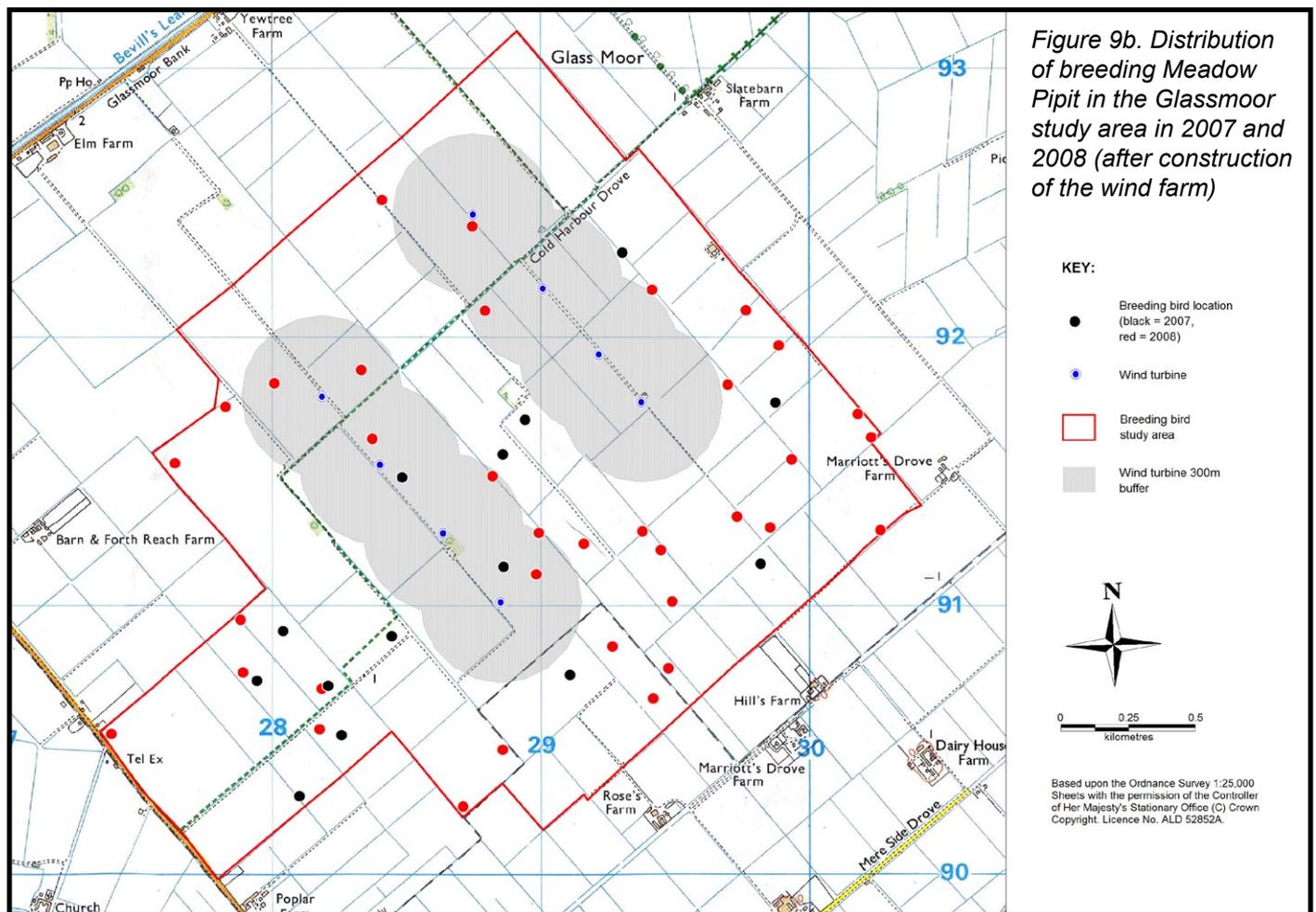
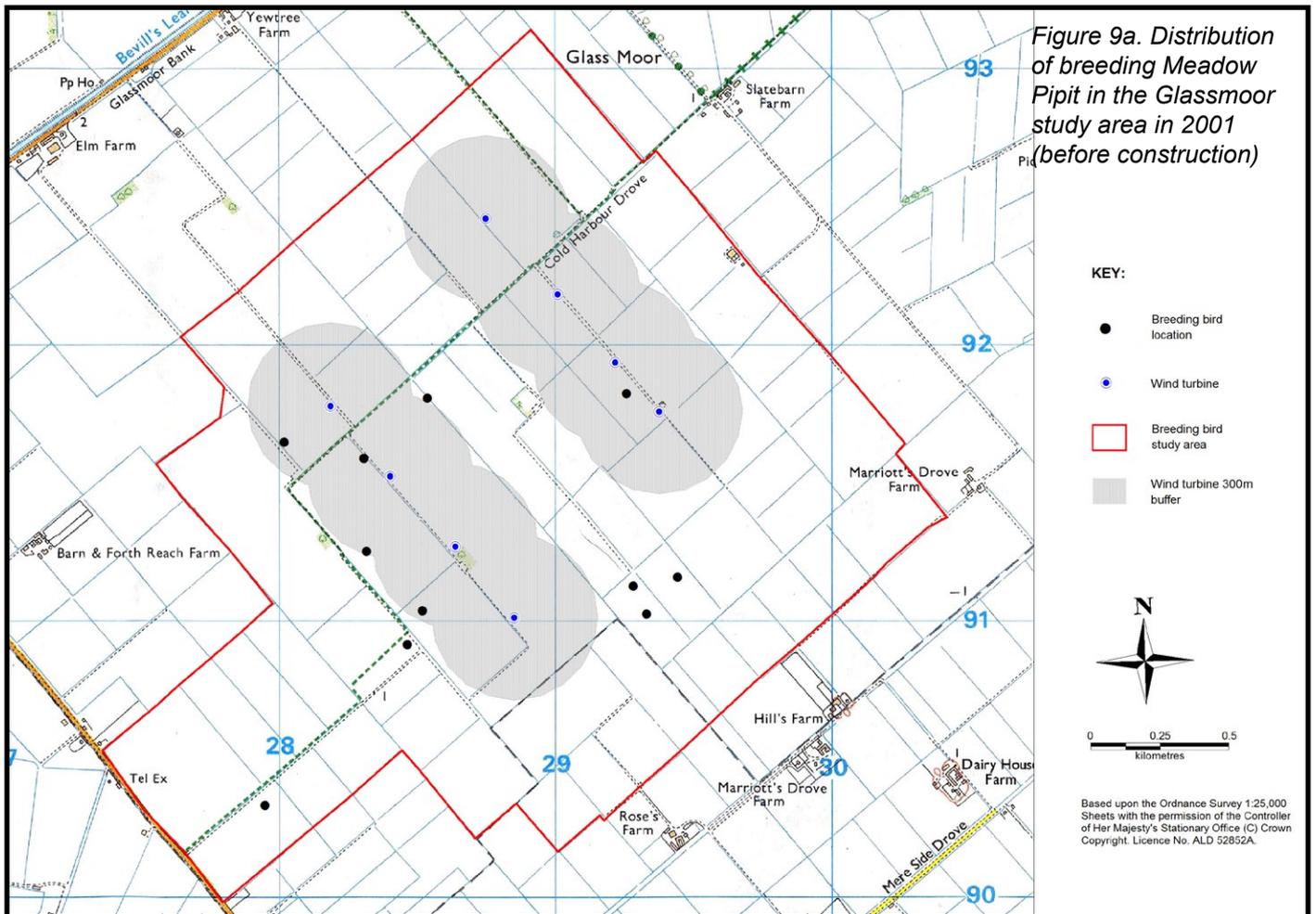
Figure 8b. Distribution of breeding Skylark in the Glassmoor study area in 2007 and 2008 (after construction of the wind farm)

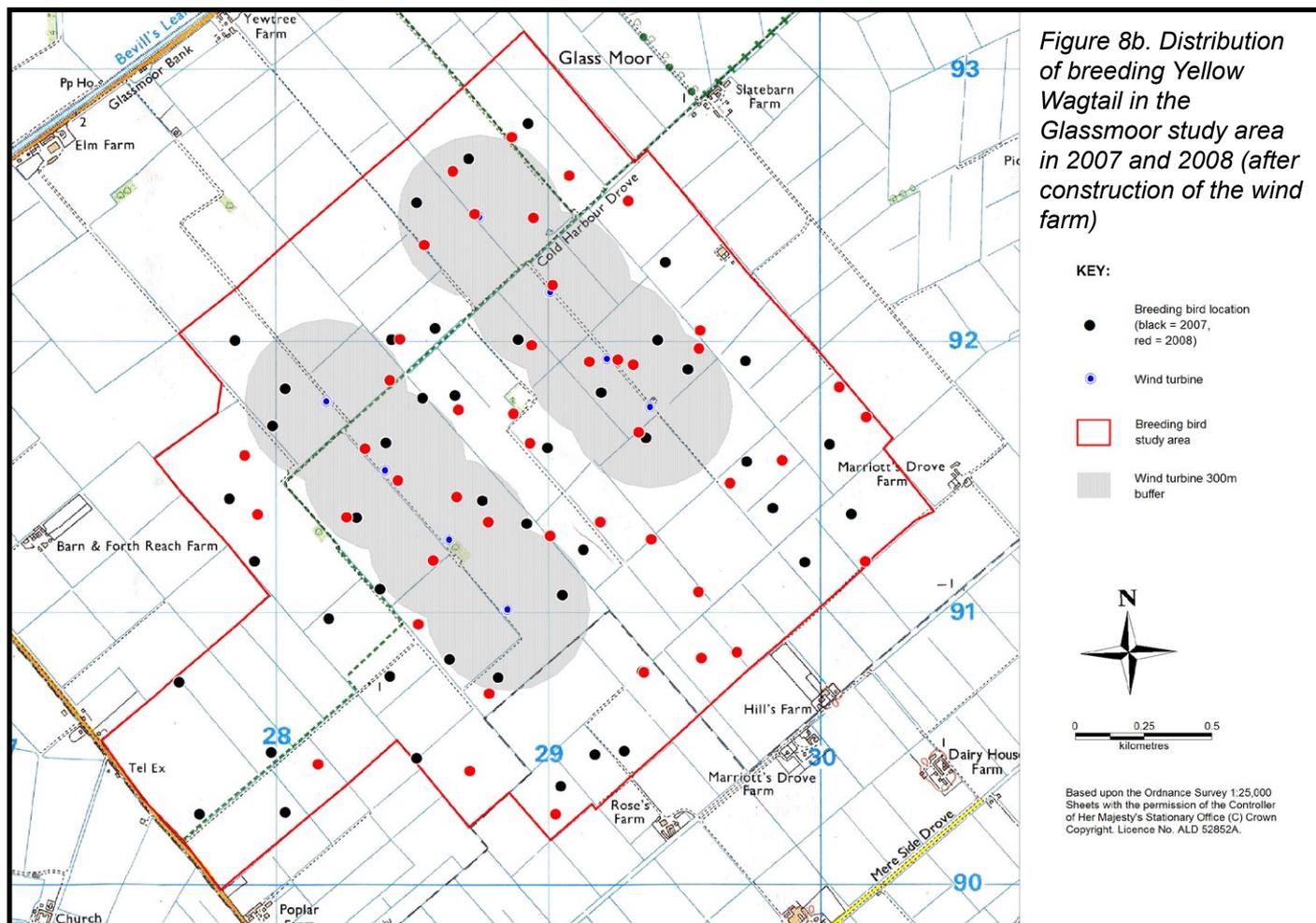
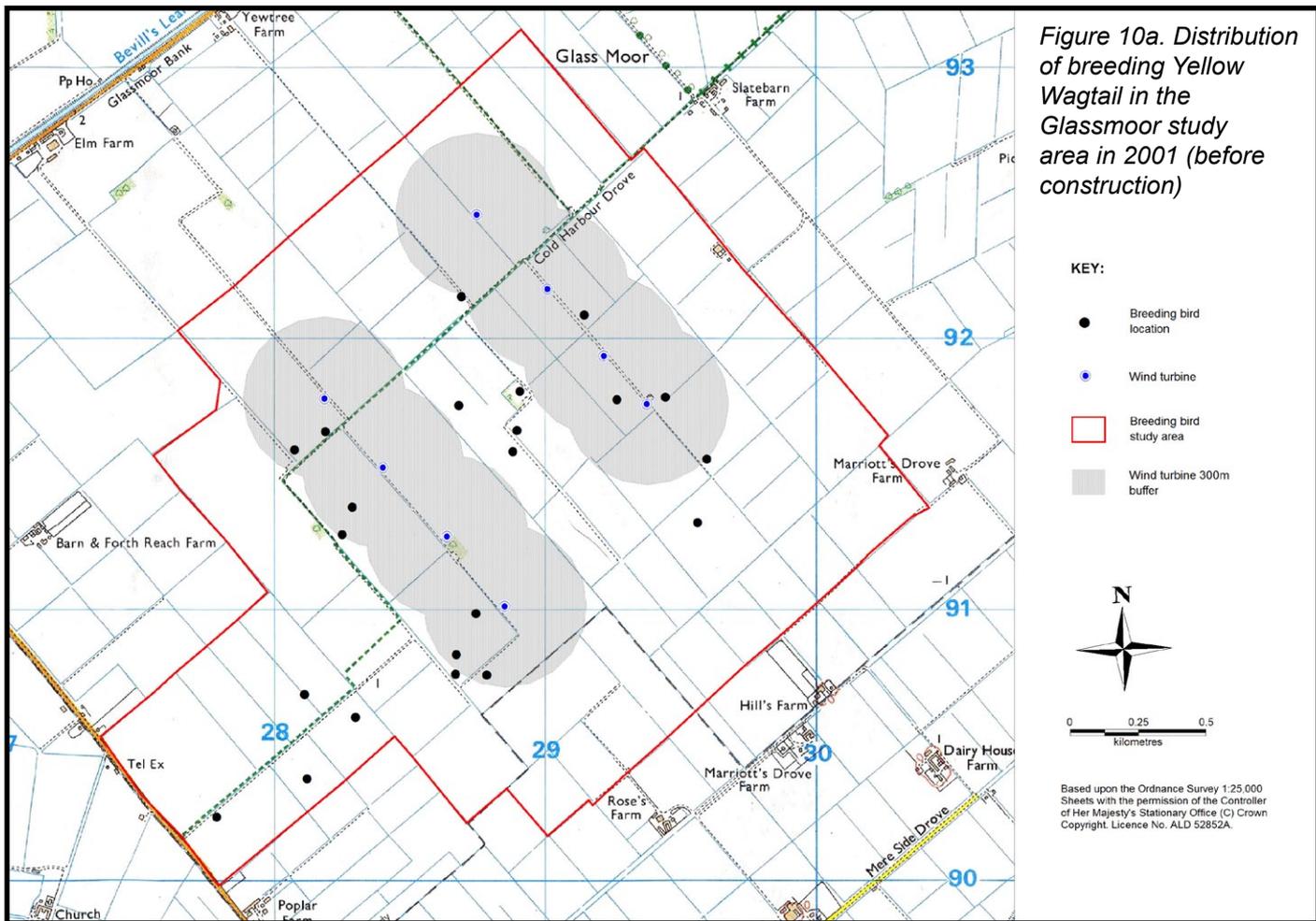
KEY:

- Breeding bird location (black = 2007, red = 2008)
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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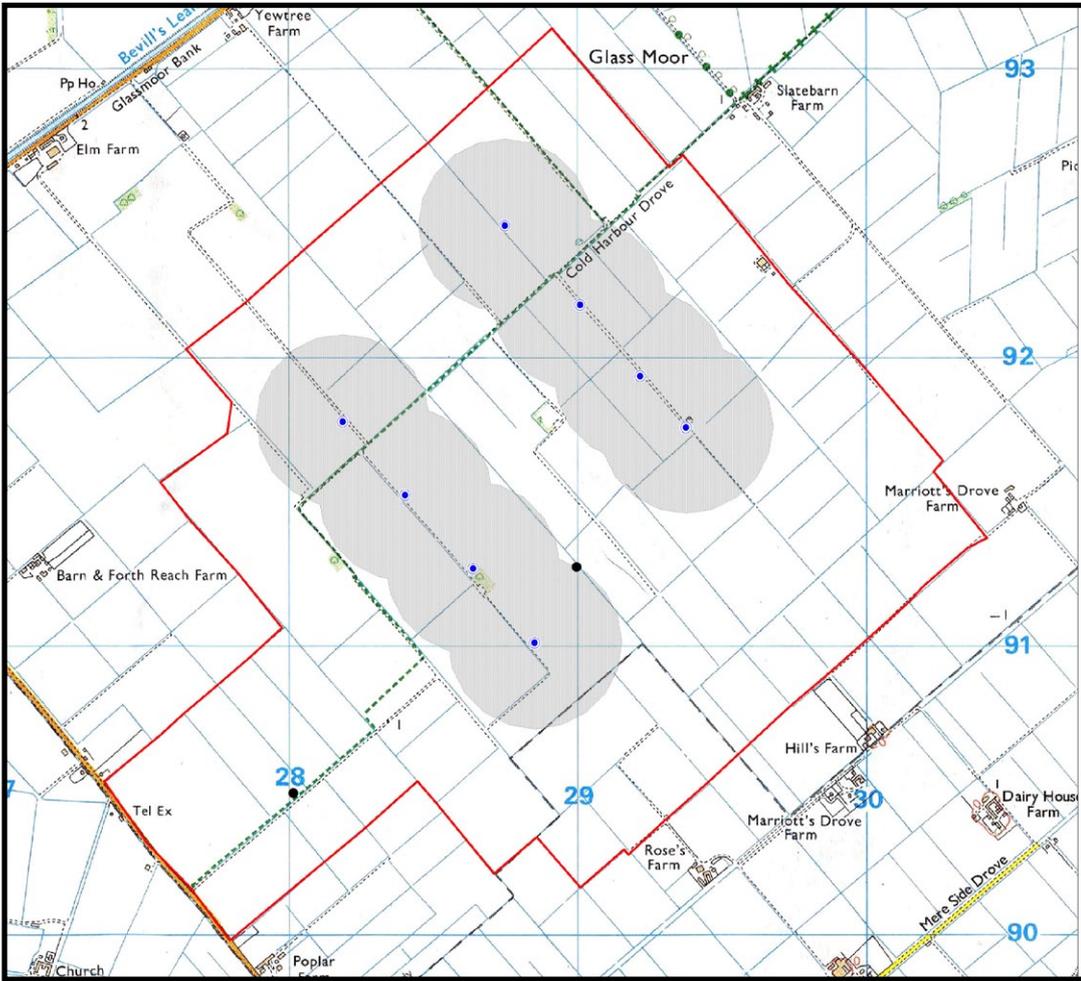
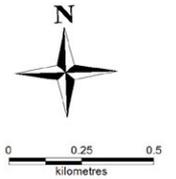


Figure 11a. Distribution of breeding Sedge Warbler in the Glassmoor study area in 2001 (before construction)

- KEY:
- Breeding bird location
 - Wind turbine
 - Breeding bird study area
 - Wind turbine 300m buffer



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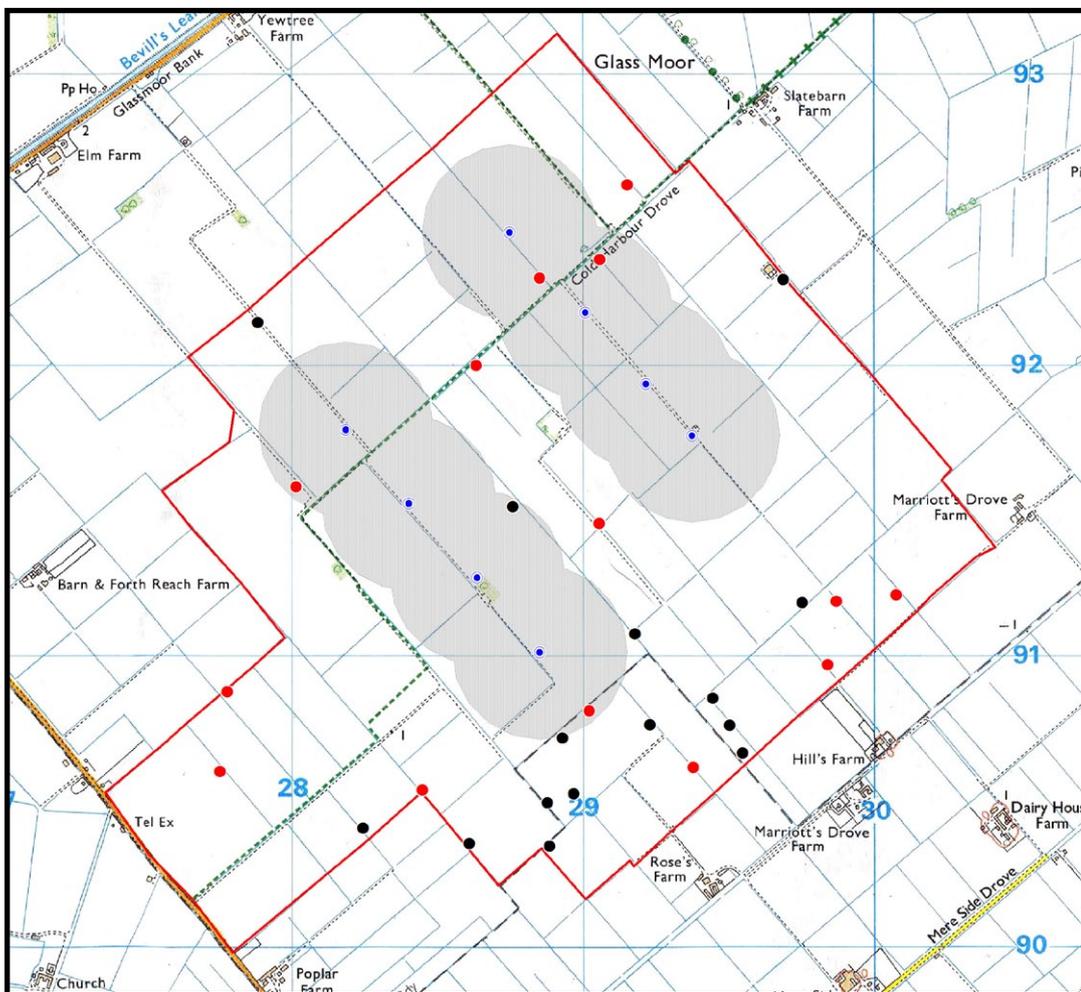
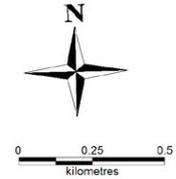


Figure 11b. Distribution of breeding Sedge Warbler in the Glassmoor study area in 2007 and 2008 (after construction of the wind farm)

- KEY:
- Breeding bird location (black = 2007, red = 2008)
 - Wind turbine
 - Breeding bird study area
 - Wind turbine 300m buffer



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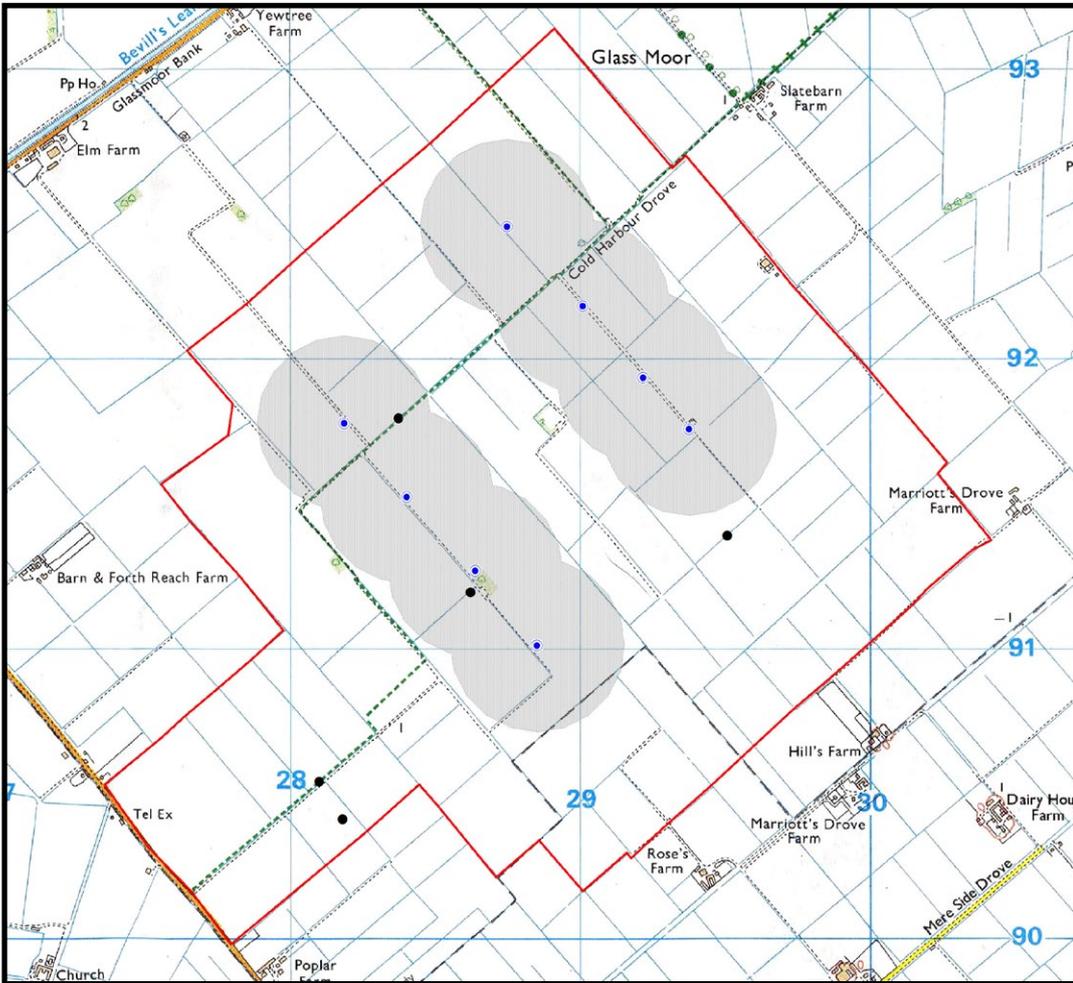
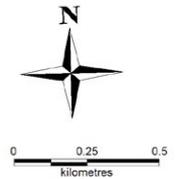


Figure 12a. Distribution of breeding Reed Warbler in the Glassmoor study area in 2001 (before construction)

- KEY:
- Breeding bird location
 - Wind turbine
 - Breeding bird study area
 - Wind turbine 300m buffer



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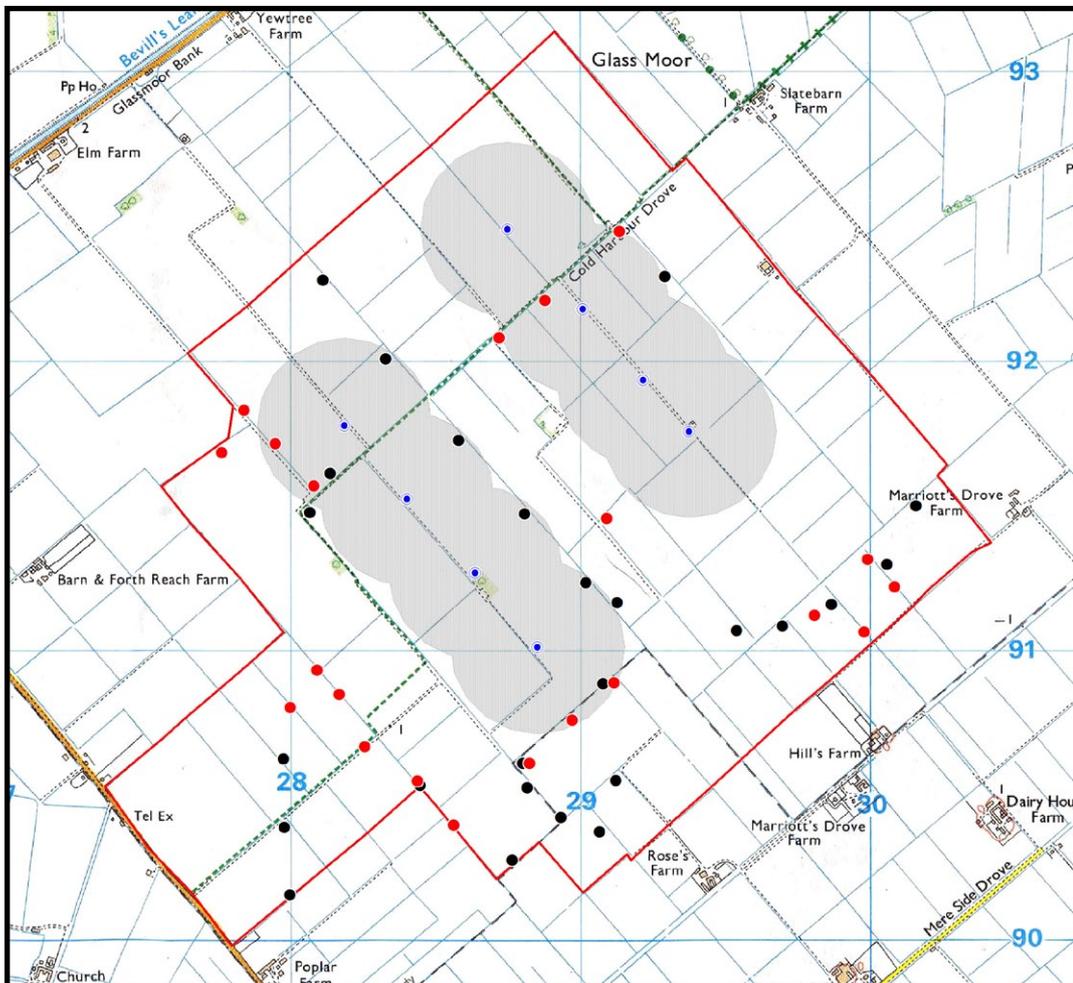
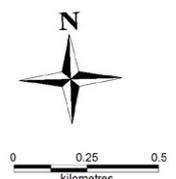


Figure 12b. Distribution of breeding Reed Warbler in the Glassmoor study area in 2007 and 2008 (after construction of the wind farm)

- KEY:
- Breeding bird location (black = 2007, red = 2008)
 - Wind turbine
 - Breeding bird study area
 - Wind turbine 300m buffer



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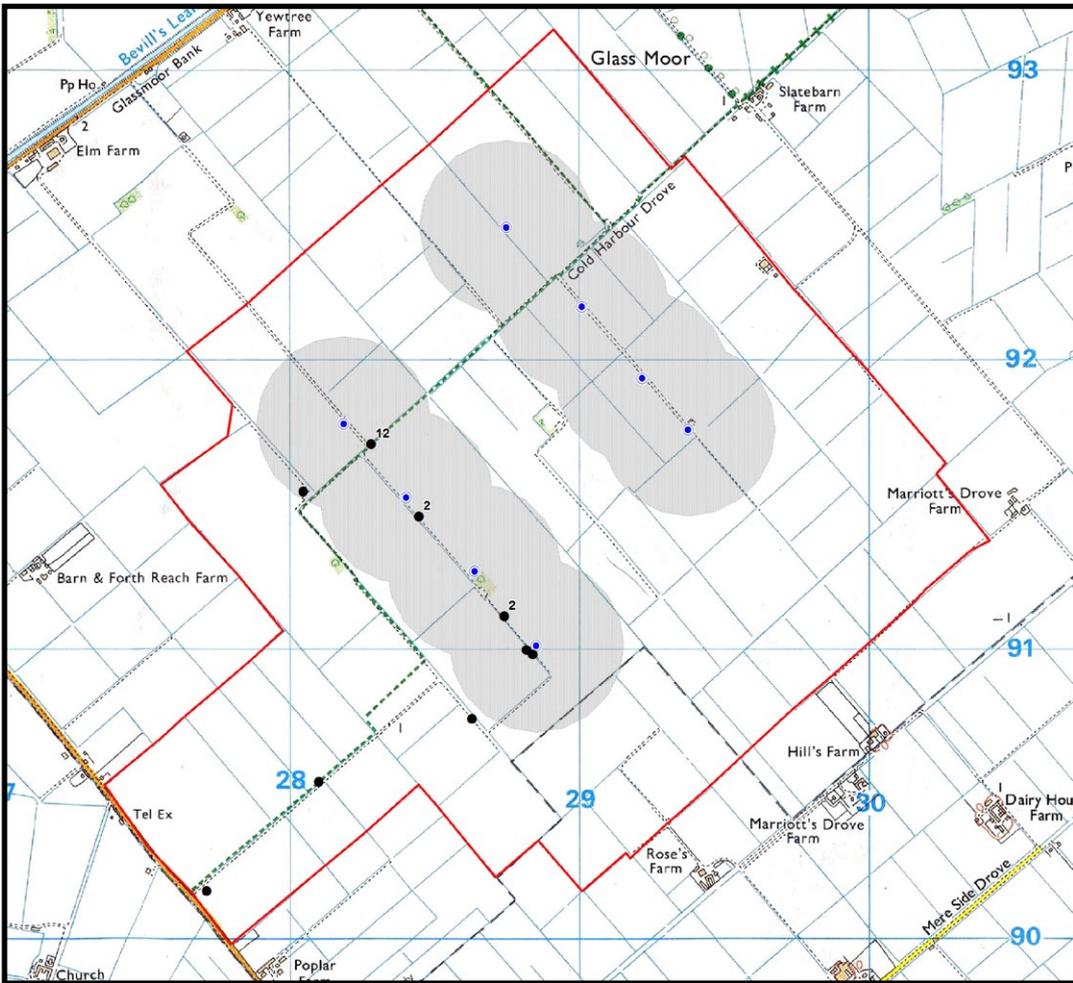
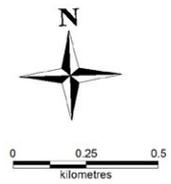


Figure 13a. Distribution of breeding Linnet in the Glassmoor study area in 2001 (before construction)

KEY:

- Breeding bird location
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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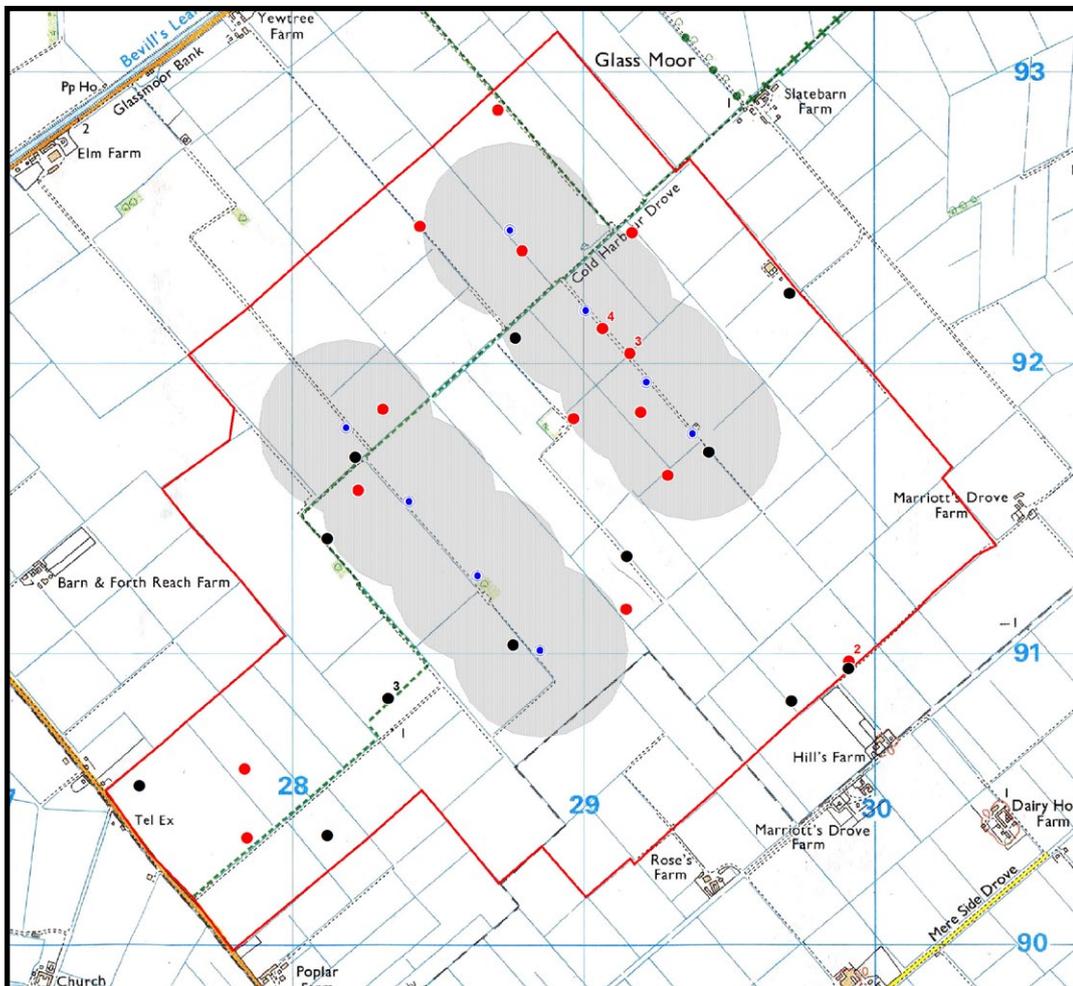
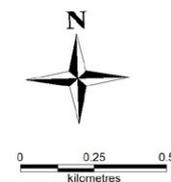


Figure 13b. Distribution of breeding Linnet in the Glassmoor study area in 2007 and 2008 (after construction of the wind farm)

KEY:

- Breeding bird location (black = 2007, red = 2008)
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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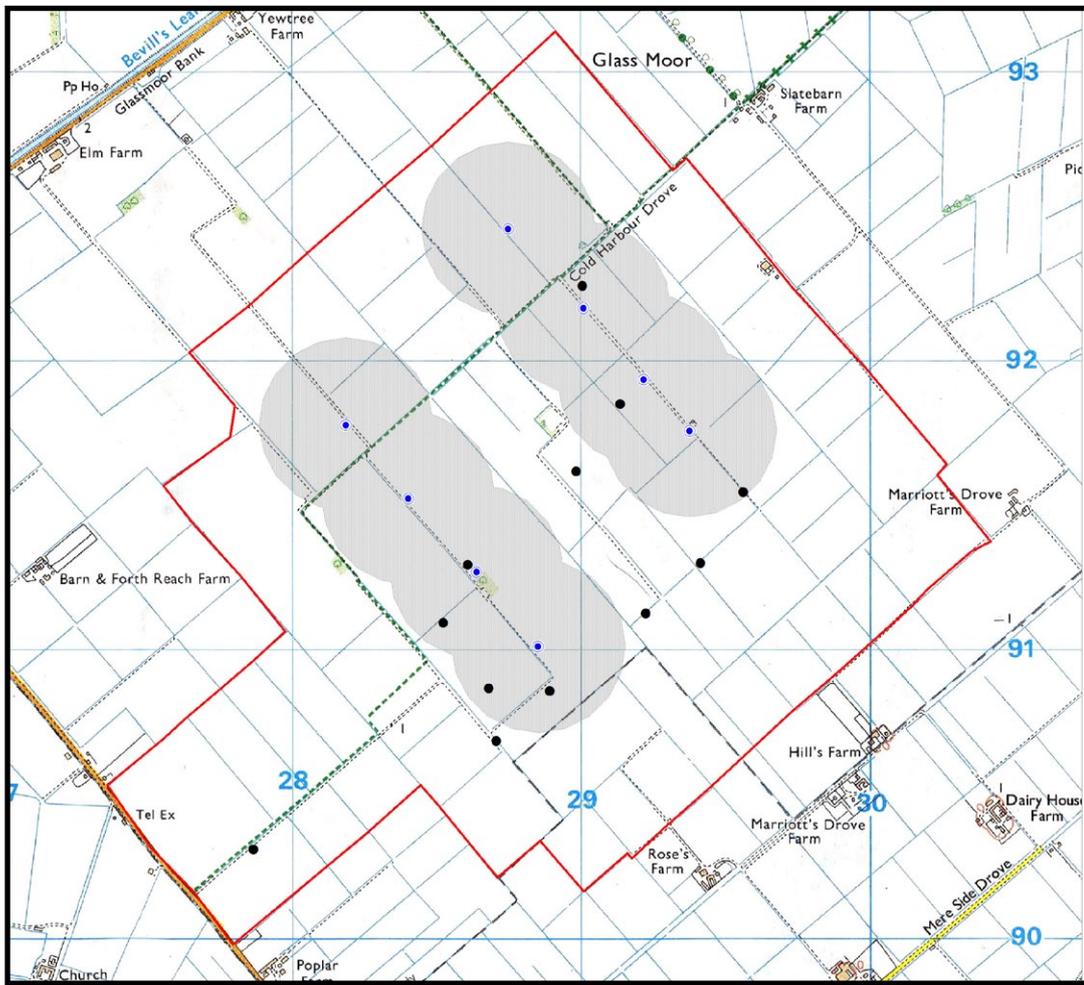
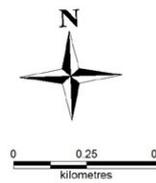


Figure 14a. Distribution of breeding Reed Bunting in the Glassmoor study area in 2001 (before construction)

KEY:

- Breeding bird location
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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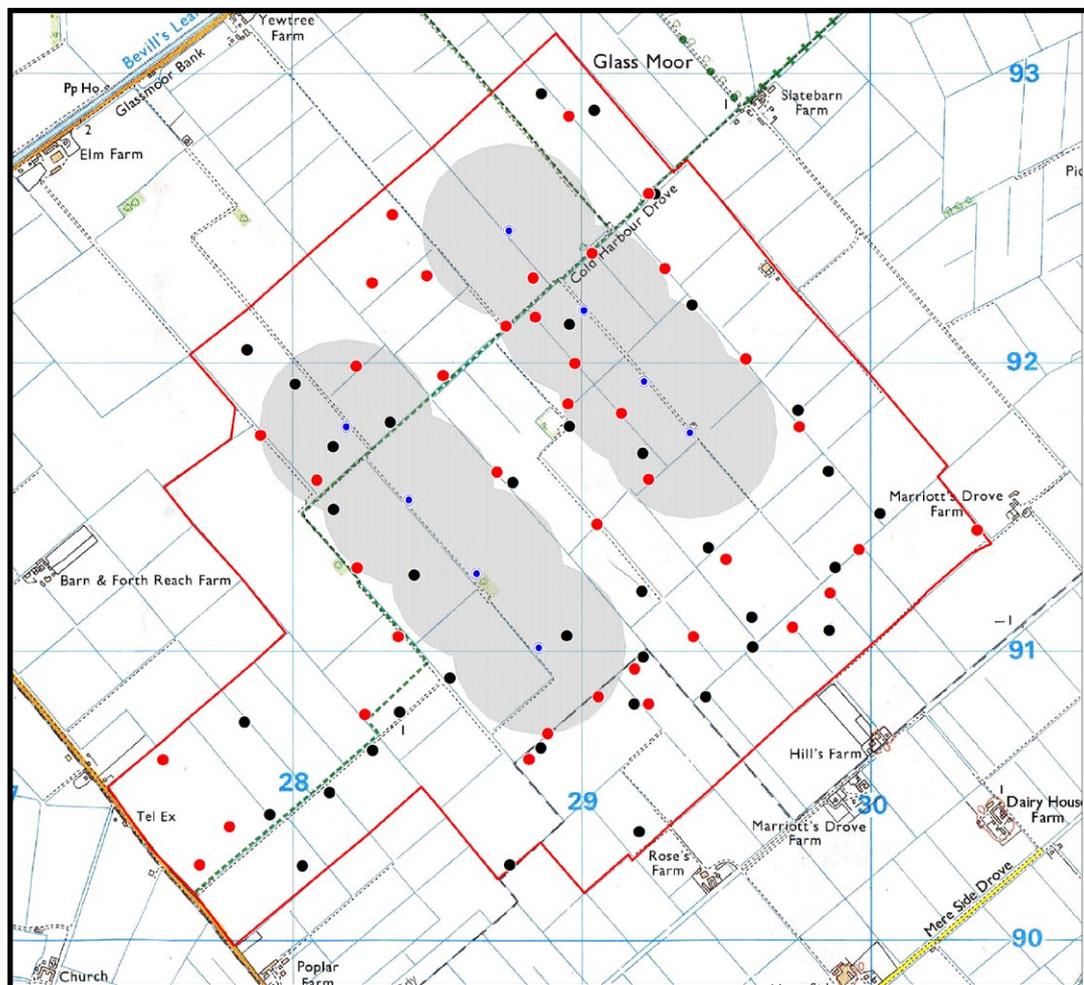
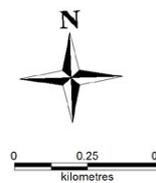


Figure 14b. Distribution of breeding Reed Bunting in the Glassmoor study area in 2007 and 2008 (after construction of the wind farm)

KEY:

- Breeding bird location (black = 2007, red = 2008)
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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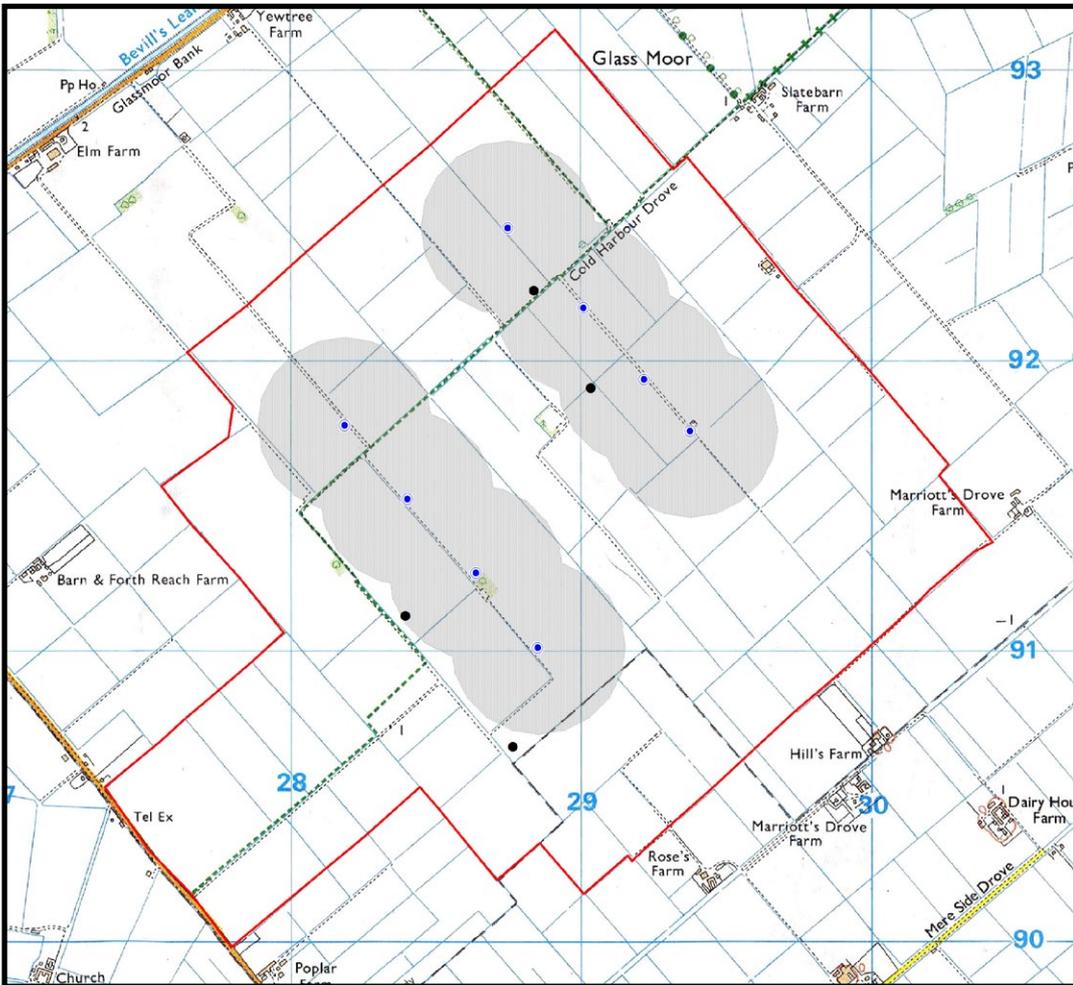
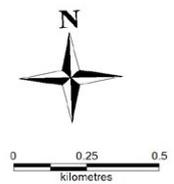


Figure 15a. Distribution of breeding Corn Bunting in the Glassmoor study area in 2001 (before construction)

KEY:

- Breeding bird location
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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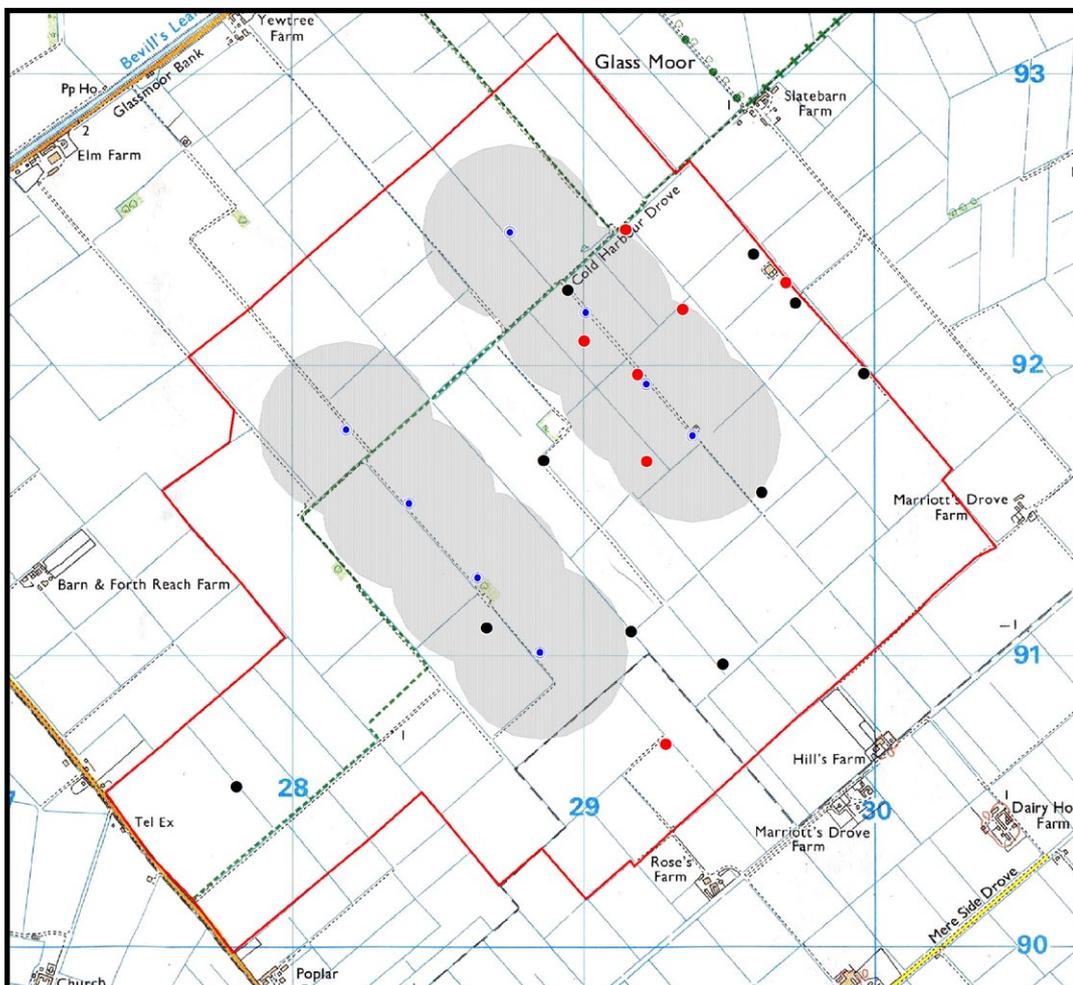
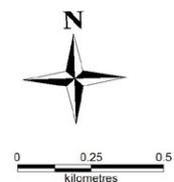


Figure 15b. Distribution of breeding Corn Bunting in the Glassmoor study area in 2007 (after construction of the wind farm)

KEY:

- Breeding bird location (black = 2007, red = 2008)
- Wind turbine
- Breeding bird study area
- Wind turbine 300m buffer



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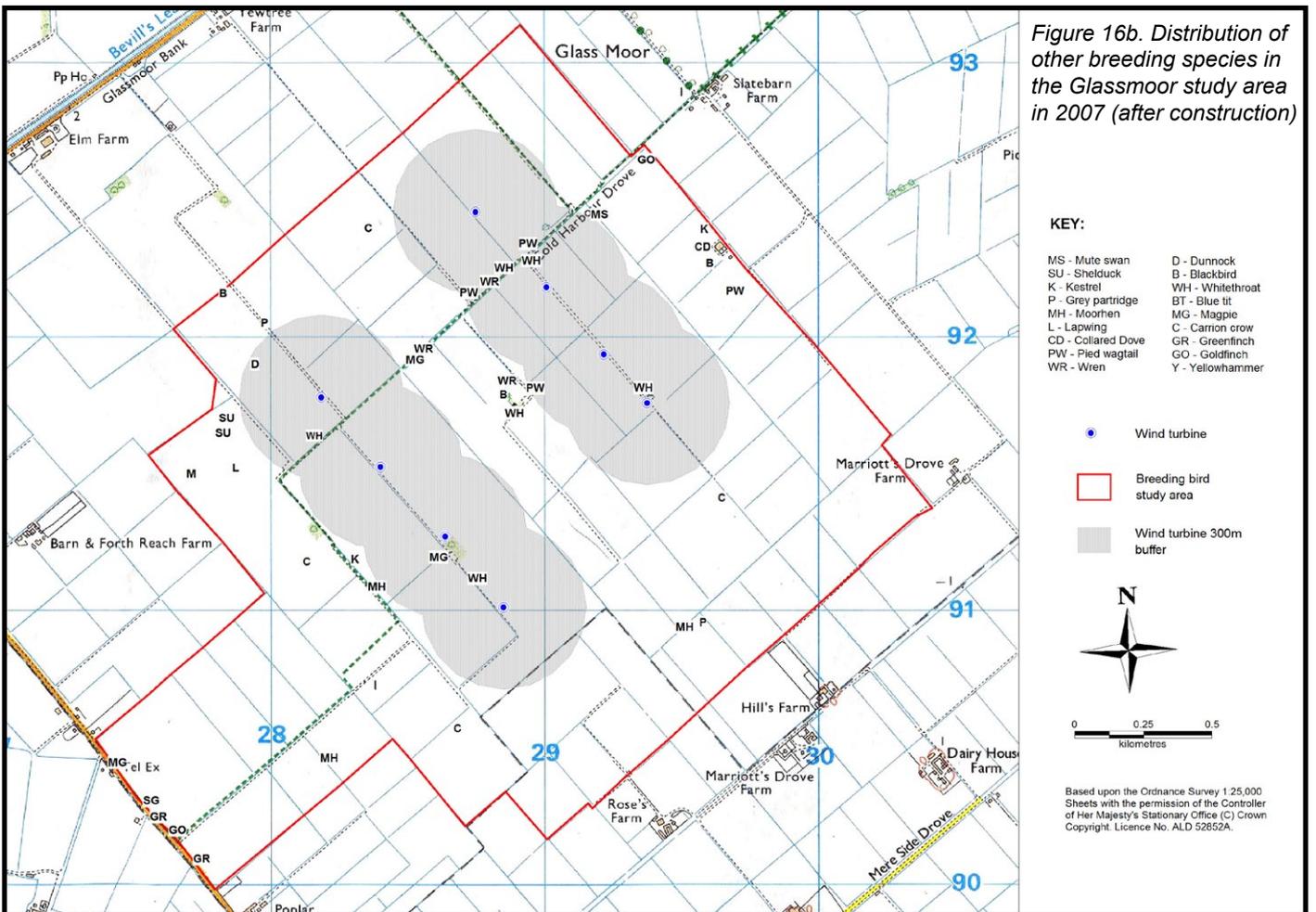
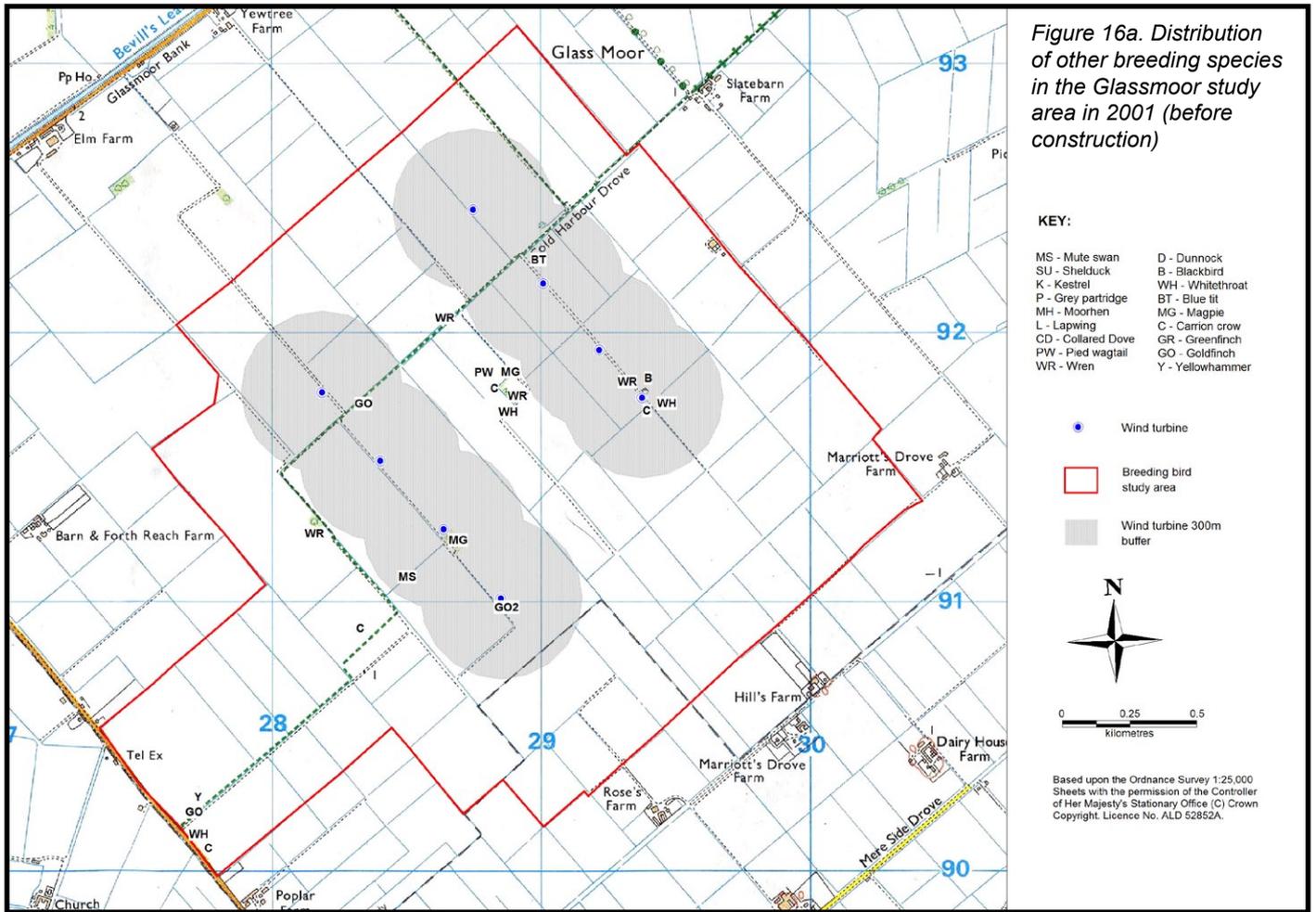


Figure 16c. Distribution of other breeding species in the Glassmoor study area in 2008 (after construction)

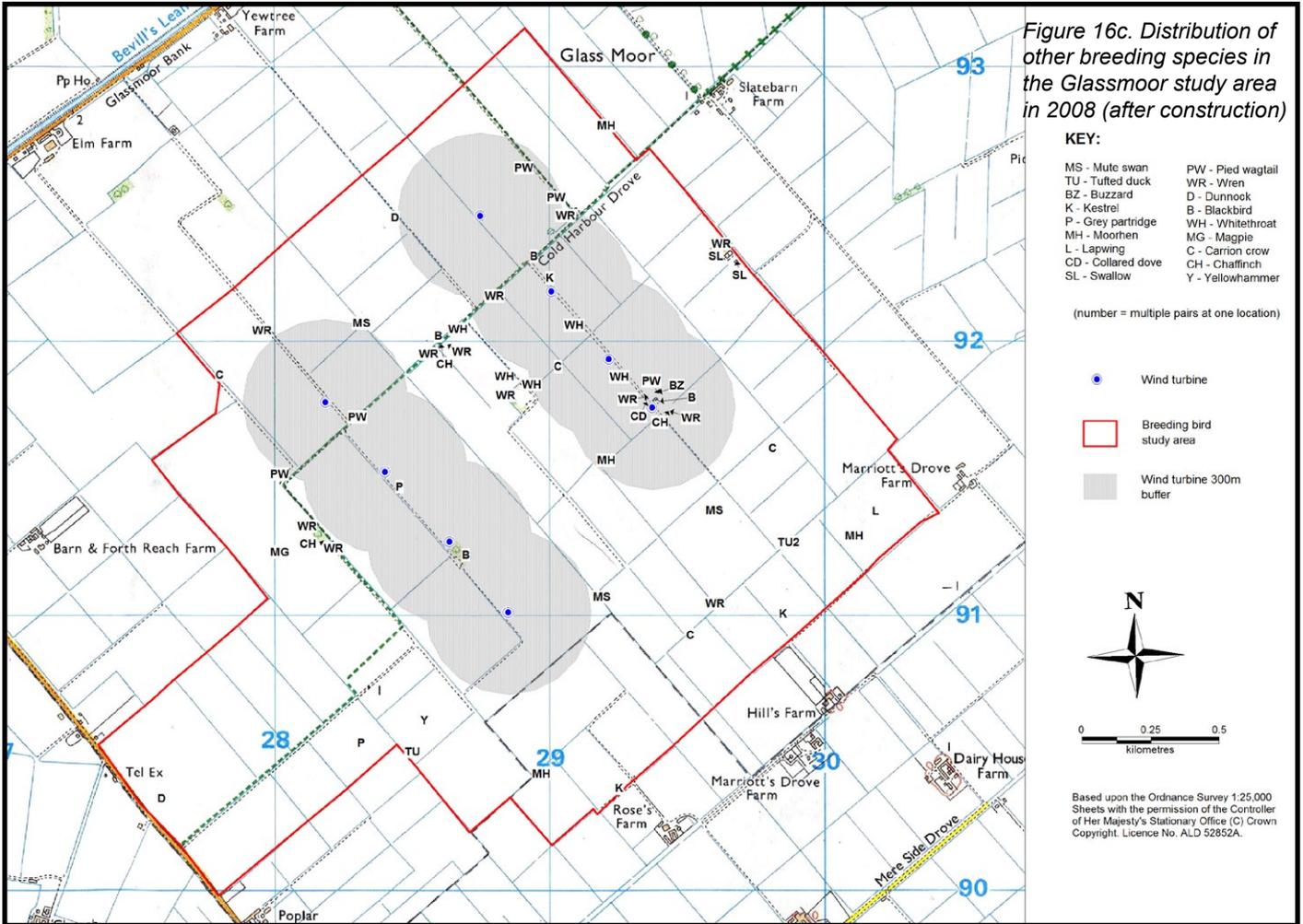


Figure 17. Skylark distribution in relation to wind turbines

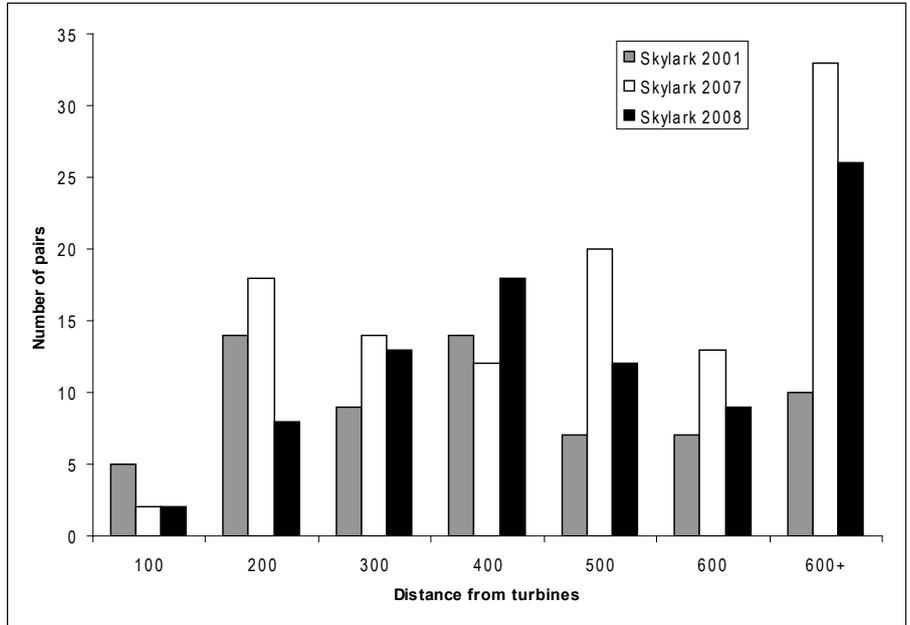


Figure 18. Meadow pipit distribution in relation to wind turbines

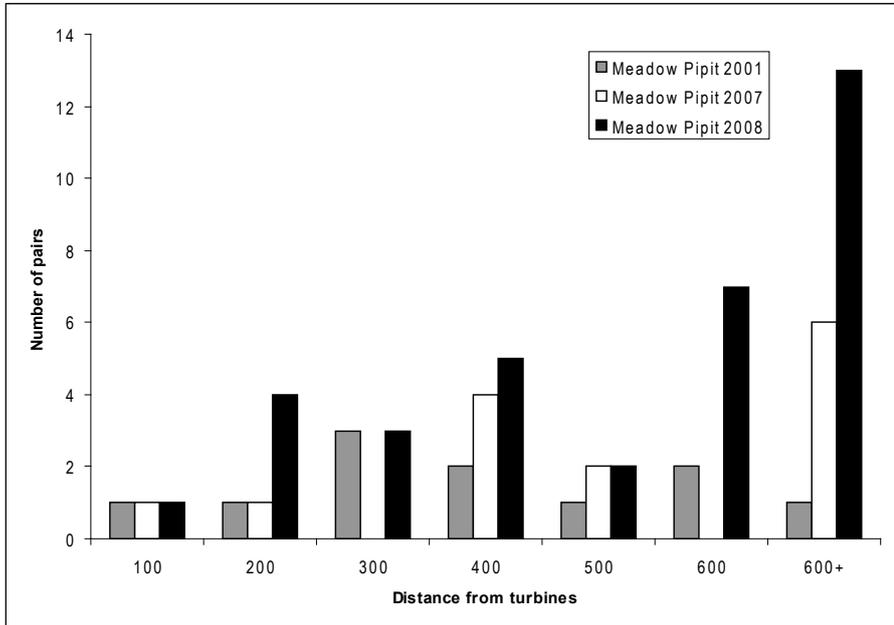


Figure 19. Yellow wagtail distribution in relation to wind turbines

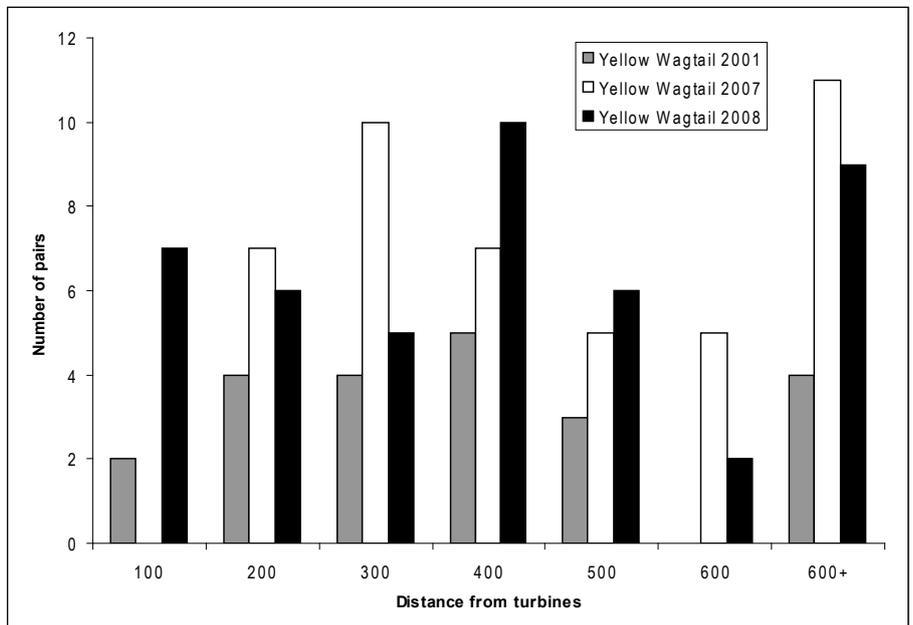


Figure 20. Reed Bunting distribution in relation to wind turbines

