TECHNICAL APPENDIX 9.7: TORFICHEN WIND FARM HABITATS REGULATION APPRAISAL REPORT

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INTRODUCTION

1. This technical appendix provides the information required under the Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004 (as amended), specifically related to avian nature conservation issues raised by the Proposed Development. The information provided here is to support the competent authority in establishing, firstly, whether the construction, operation and decommissioning of the Proposed Development, either alone or in combination with other plans or projects, is likely to have a significant effect on European sites, having had regard to the qualifying interests and the conservation objectives. This first stage analysis is completed without reference to mitigation.
2. Where a plan or project is not directly connected with or necessary to the management of the European site, and where it cannot be excluded, on the basis of objective information, that the plan or project will have a significant effect, the competent authority is duty bound to complete an Appropriate Assessment to determine whether the likely significant effect would have an adverse effect on the integrity of the European site(s). The integrity of the European Sites is considered with reference to the best scientific knowledge and with regards to the conservation objectives of the European Sites, specifically the species for which the sites were designated and the habitat upon which they depend. This technical appendix should be read in conjunction with the accompanying chapter and figures.
3. This Technical Appendix provides information on the existing baseline for the designated populations (and that could be affected by the Proposed Development) and an assessment of the effects of the Proposed Development on those populations alone and in combination with other plans and projects in the area. The field studies, evaluation and assessment of the effects of the proposed wind farm on the area's bird populations have been reported fully in Chapter 9: Ornithology in Volume 1 of the Environmental Impact Assessment (EIA) Report. The information presented in this report draws on that work but focuses on the key species that are qualifying features of the Special Protection Areas (SPA) sites.

OBJECTIVES

4. The purpose of this technical appendix is:
   - To assess the potential for likely significant effects upon the European site(s) from the construction and operation of the Proposed Development, either alone or in combination with other plans or projects and in the absence of any mitigation (this assessment is known as the screening stage); and
   - If any likely significant effects are identified through the screening stage, to consider whether the Proposed Development has the potential to have an adverse effect on the integrity of the European site(s), having had regard to their conservation objectives and the mitigation measures proposed.

PARAMETERS FOR THE HRA

5. The assessment presented here is based on the Proposed Development as described in Chapter 3: Project Description in Volume 1 of the EIA Report. Specific parameters relevant to this assessment include using a 150 m rotor diameter turbine. Hub heights would be 105 m, so rotor height would be 30-180 m for the lowest turbines.
6. Blade rotational speeds would be, on average, about 7.5 revolutions per minute. The Proposed Development will include concrete bases for the 18 wind turbine foundations, the wind turbines themselves and

associated electrical transformers, electrical sub-station and battery storage compounds and control buildings, and on-site infrastructure (underground cabling, access tracks, off-site road improvements, watercourse crossings and crane hardstandings). A complete description of the Proposed Development for the purposes of the EIA Regulations is provided in Volume 1 Chapter 3 of the EIA Report.

7. All of the on-site cabling will be under-grounded. Operation and minor wind farm maintenance will occur throughout the year, with additional annual servicing.

CONSULTATION

8. NatureScot has advised in scoping that the Proposed Development has the potential to impact on pink-footed goose, a qualifying feature of the Gladhouse Reservoir, Fala Flow, Firth of Forth and Westwater SPA/Ramsar sites, so a Habitats Regulations Appraisal (HRA) will be needed. This Technical Appendix provides that appraisal. Pink-footed goose is the only SPA qualifying species for which the Proposed Development lies within the SPA connectivity range.

BASELINE DATA

9. A comprehensive range of bird surveys have been undertaken at the site between April 2021 and March 2023. This has included surveys over two breeding seasons (2021 and 2022) and two winter periods (2021-22 and 2022-23). These surveys comprised:
    - year-round vantage point surveys to quantify bird flight activity;
    - breeding bird walkover mapping survey;
    - species-specific breeding bird surveys;
    - autumn/winter walkover surveys; and
    - autumn/winter waterfowl feeding surveys.
10. Full details of the surveys, dates and weather conditions are given in Technical Appendices 9.1-9.4.

SPA SPECIES' BASELINE CONDITIONS

11. Only one possible SPA species was recorded during the baseline surveys within the potential disturbance zone:
    - Pink-footed Goose.
12. That same species was the only SPA species recorded at risk of collision (i.e. flying through the site at rotor height).

STAGE ONE HABITATS REGULATIONS APPRAISAL – SCREENING (LIKELY SIGNIFICANT EFFECTS TESTS)

13. In this section, each SPA that could be affected by the Proposed Development is considered in terms of its qualifying features to determine whether any Likely Significant Effects (LSE) under the Habitats Regulations could occur. SPAs that could be affected by the Proposed Development are identified and the designated species that could be affected.

14. The initial assessment for the LSE test was based on whether the Proposed Development falls within the core connectivity range of each qualifying species of each SPA (as set out in SNH 2016) and whether there was any possible pathway to a significant impact. Each SPA is considered in turn.

15. The potential connectivity of each of these SPAs to the Proposed Development is summarised in the EIA Report Table 9.5. This lists the qualifying features for each SPA, the distance from the site at its closest point and an initial assessment of whether the site falls within the core range of each (SNH 2016). As set out in this guidance, "*In most cases, the core range should be used when determining whether there is connectivity between the proposal and the qualifying interests*", so this has been used for this assessment (though with consideration of the maximum ranges too).

GLADHOUSE RESERVOIR SPA/RAMSAR

16. The Gladhouse Reservoir SPA/Ramsar site lies 700 m west from the Proposed Development site boundary and 940 m from the closest proposed turbine. It is designated (under Article 4.2) for its wintering population of pink-footed geese (which roost on the reservoir at night and forage on the surrounding farmland up to 15-20 km from the roost). The SPA citation cites a population of 10,400 pink-footed geese (over 10% of the international population), though numbers have been lower in recent years (hence its condition being 'unfavourable declining').

Table 1-1: Gladhouse Reservoir SPA: Determining Potential for Likely Significant Effects (LSE)

Qualifying Interest	*Summary Condition*	*Likely Significant Effect*
Pink-footed Goose	Unfavourable declining. Negative pressures include no active management and water management	Collision risk Disturbance during construction Disturbance during operation

FALA FLOW SPA/RAMSAR

17. The Fala Flow SPA/Ramsar site lies 6.4 km north-east of the Proposed Development. It is designated for its wintering population of pink-footed geese. The SPA citation cites a population of 2,400 pink-footed geese (2% of the international population), though numbers have been higher in recent years.

Table 1-2: Fala Flow SPA: Determining Potential for Likely Significant Effects (LSE)

Qualifying Interest	*Summary Condition*	*Likely Significant Effect*
Pink-footed Goose	Favourable maintained. Water management has been identified as a negative pressure.	Collision risk Disturbance during construction Disturbance during operation

FIRTH OF FORTH SPA/RAMSAR

18. The Firth of Forth SPA/Ramsar site lies 16.5 km north of the Proposed Development. It is designated for a range of internationally important wintering waterfowl populations, and passage Sandwich terns. The only species for which the SPA could have any connectivity with the Proposed Development, given the distance, is pink-footed goose. The SPA citation cites a population of 10,852 pink-footed geese (6% of the international population), though numbers have been higher in recent years.

Table 1-3: Firth of Forth SPA: Determining Potential for Likely Significant Effects (LSE)

Qualifying Interest	*Summary Condition*	*Likely Significant Effect*
Pink-footed Goose	Favourable maintained. No negative pressures identified.	Collision risk Disturbance during construction Disturbance during operation

WESTWATER SPA/RAMSAR

19. The Westwater SPA/Ramsar site lies 19.5 km west of the Proposed Development. It is designated for its wintering population of pink-footed geese and its wintering waterbird assemblage. The SPA citation cites a population of 29,600 pink-footed geese (15% of the international population).

Table 1-4: Westwater SPA: Determining Potential for Likely Significant Effects (LSE)

Qualifying Interest	*Summary Condition*	*Likely Significant Effect*
Pink-footed Goose	Favourable maintained. No negative pressures identified.	Collision risk Disturbance during construction Disturbance during operation

POTENTIAL IMPACTS ON PINK-FOOTED GEESE

20. The potential impacts that could lead to a Likely Significant Effect were identified as the following. Each is considered in turn:
    - Disturbance of feeding birds during construction
    - Disturbance of feeding birds during operation
    - Collision risk during operation.
    - Disruption to flight lines (barrier effect).

COLLISION RISK

21. Collision risk modelling was carried out for pink-footed goose using the NatureScot standard model (Band *et al.* 2007). The direct flight model was applied as their flights were essentially direct ones through the site. Further modelling details are given in Chapter 9, Section 9.4.2.9 and Technical Appendix 9.6.

22. The collision risk predictions from the model for pink-footed geese are summarised in Table 5, applying the NS-recommended precautionary 99.8% avoidance rate (SNH 2018). The predicted collision risk of 13.4 geese per year based on the 2012-22 data and 25.3 based on the 2022-23 data gives an overall predicted risk of 19.4 goose collisions per year. A Likely Significant Effect from collision risk could not be excluded and this was taken forward for Appropriate Assessment for all four SPAs within the 20 km connectivity range.

Table 1-5: Collision Risk Modelling Predictions

Species	Precautionary Predicted Number of Collisions per Year (NS avoidance rate)	
	2021-22	2022-23
Pink-footed Goose	13.4	25.3

DISTURBANCE RISK – CONSTRUCTION

23. Pink-footed goose feeding flocks were regularly seen in the fields to the east of the Proposed Development, and some of these fields are within the potential impact zone during construction. This has been taken as a precautionary 600 m buffer from the Proposed Development infrastructure. A peak count of 2,635 pink-footed geese was recorded in this zone. A Likely Significant Effect from construction disturbance could not be excluded and this was taken forward for Appropriate Assessment for all four SPAs within the 20 km connectivity range.

DISTURBANCE RISK – OPERATION

24. Disturbance of geese during operation is likely to be restricted to the zone around the wind turbines rather than the whole site infrastructure, so a precautionary 600 m buffer around the turbines was used to define the potential impact zone. The peak count recorded in this zone was 1,125. A Likely Significant Effect from operational disturbance could not be excluded and this was taken forward for Appropriate Assessment for all four SPAs within the 20 km connectivity range.

BARRIER EFFECT

25. The Proposed Development lies within a pink-footed goose flight corridor, but only a short distance would be required to divert around the wind farm if it did pose a barrier to the goose flight movements. It would not block any flight route into important feeding areas or access to the birds' roost. Any barrier effect would, at most, require only a short detour around the wind farm. As a result, it was concluded that a barrier effect would result in no Likely Significant Effect on any SPA pink-footed goose population.

CONCLUSIONS OF PHASE ONE HRA SCREENING

26. Likely Significant Effects could not be excluded for disturbance during construction and operation, and collision risk, for all four SPAs within 20 km of the Proposed Development:
    - Gladhouse Reservoir SPA/Ramsar pink-footed goose population
    - Fala Flow SPA/Ramsar pink-footed goose population
    - Firth of Forth SPA/Ramsar pink-footed goose population
    - Westwater SPA/Ramsar pink-footed goose population
27. All these were, therefore, taken forward for Appropriate Assessment under the second stage of the HRA assessment process.

STAGE TWO HABITATS REGULATIONS APPRAISAL – SHADOW APPROPRIATE ASSESSMENT

28. The purpose of this section of the report is to inform the Competent Authority's Habitats Regulations Assessment, to provide them with the information needed to determine whether the Proposed Development would threaten the ecological integrity of any SPA. In this case, the Competent Authority would be the Scottish Government.

29. As set out in the Stage 1 report above, Likely Significant Effects could not be excluded for disturbance during construction and operation, and collision risk, for all four SPAs within 20 km of the Proposed Development:

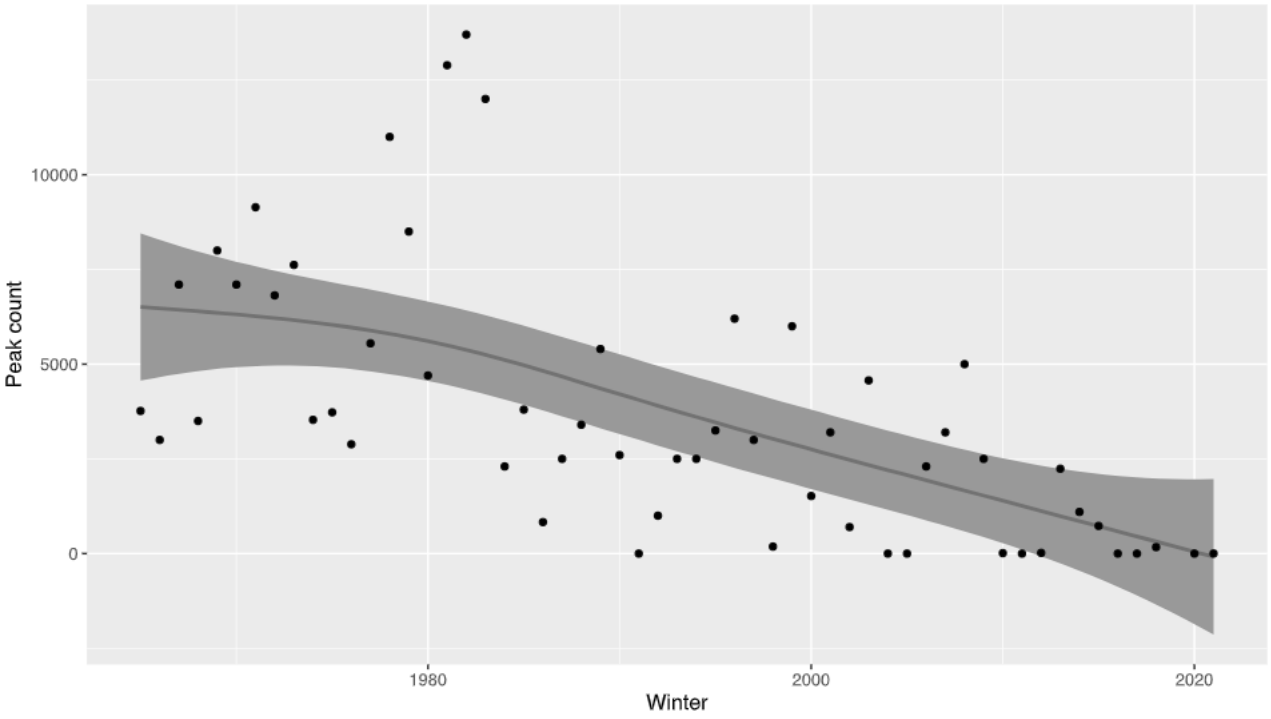
    - Gladhouse Reservoir SPA/Ramsar pink-footed goose population
    - Fala Flow SPA/Ramsar pink-footed goose population
    - Firth of Forth SPA/Ramsar pink-footed goose population
    - Westwater SPA/Ramsar pink-footed goose population

30. This shadow Appropriate Assessment report therefore addresses all of these sites and examines whether the Proposed Development might result in any adverse effect on the integrity of any of these four SPA/Ramsar sites. SPA/Ramsar site population trends are presented, giving the annual peak counts from the BTO WeBS/Goose and Swan Monitoring Programme (Austin *et al*. 2023).

GLADHOUSE RESERVOIR SPA/RAMSAR

31. Gladhouse Reservoir SPA has been classified by NatureScot as being in 'Unfavourable Decling' condition. Monitoring data show that there has been a major decline in pink-footed goose numbers using the SPA, from 10,400 at the time of citation to a current 5-year mean peak of only 85 (with no count recorded over 1,000 since 2014/15). The annual peak counts are shown in Figure 2-1.

Figure 2-1. Gladhouse Reservoir annual peak counts, 1965/66 – 2021/22

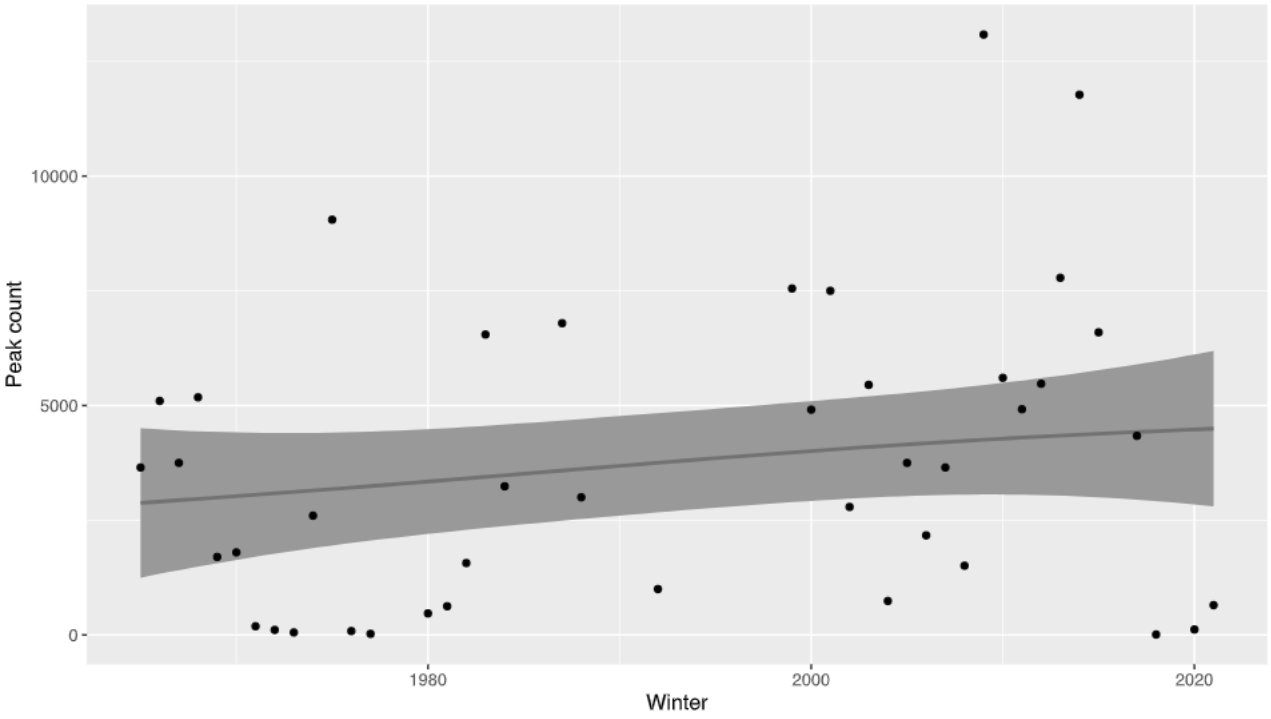


Note: the line shows the General Additive Model (GAM) line of best fit with standard error.

FALA FLOW SPA/RAMSAR

32. The Fala Flow SPA has been classified by NatureScot as being in 'Favourable' condition. The pink-footed goose population was 2,400 at the time of citation. The most recent 5-year peak count is 1,280, but the numbers recorded have been highly variable and the overall trend has been one of increase (Figure 2-2).

Figure 2-2. Fala Flow annual peak counts, 1965/66 – 2021/22

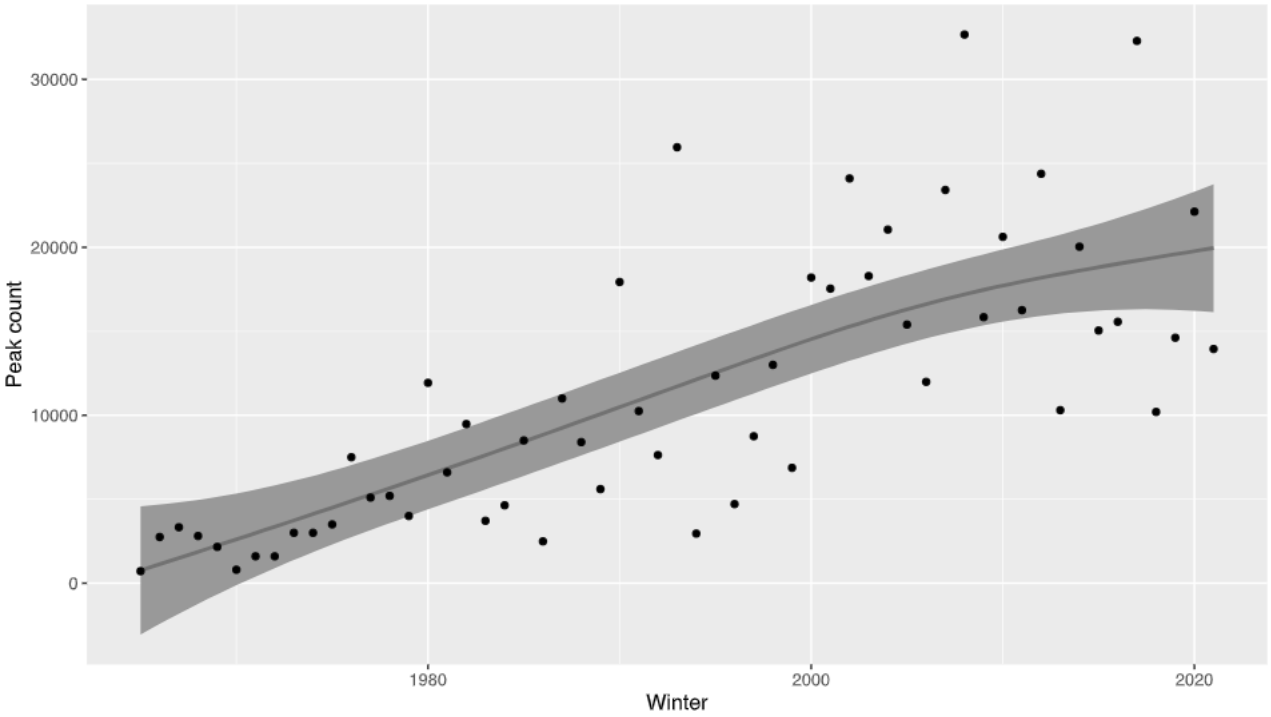


Note: the line shows the General Additive Model (GAM) line of best fit with standard error.

FIRTH OF FORTH SPA/RAMSAR

33. The Firth of Forth SPA pink-footed goose population at the time of citation was 10,852. Since then, there has been a substantial increase, with the most recent 5-year mean of 18,635. Figure 2-3 summarises increasing trend at this site. The SPA has been classified by NatureScot as being in 'Favourable' condition.

Figure 2-3. Firth of Forth annual peak counts, 1965/66 – 2021/22

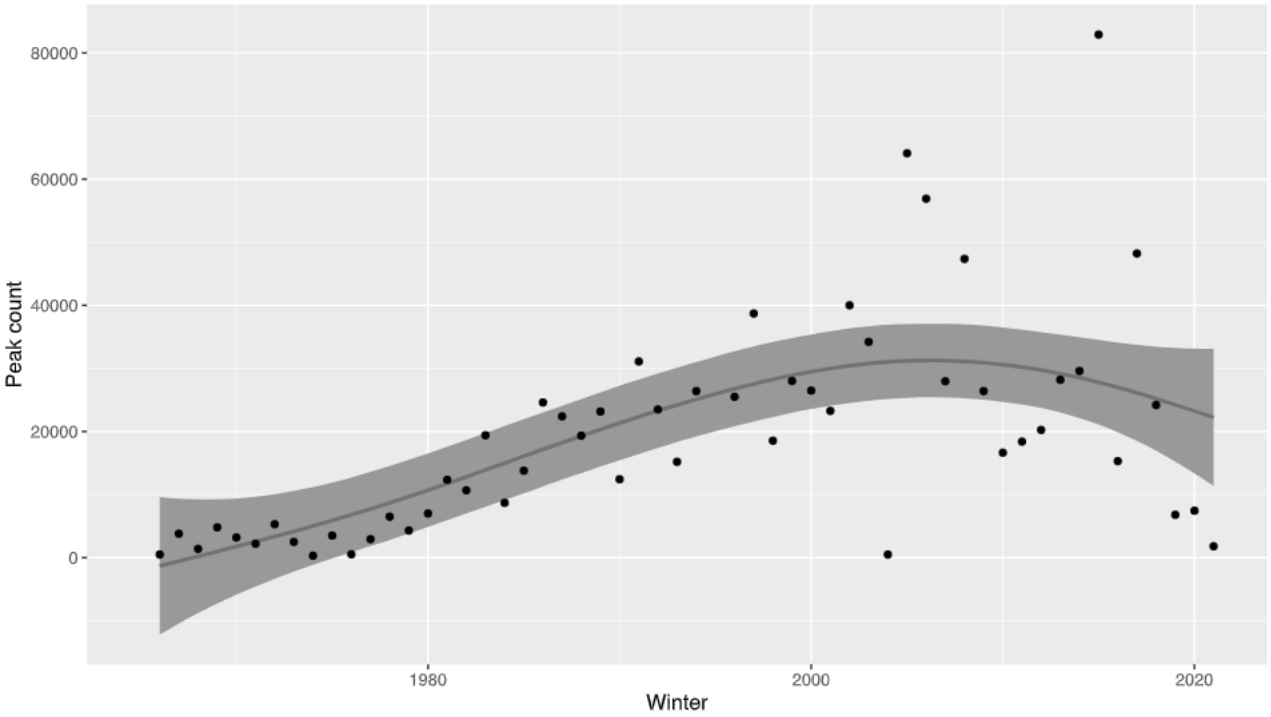


Note: the line shows the General Additive Model (GAM) line of best fit with standard error.

WESTWATER SPA/RAMSAR

34. The Westwater SPA pink-footed goose population at the time of citation was 29,600. Numbers using the SPA increased markedly, though with a more recent decline (with the most recent 5-year mean peak of 17,696). Figure 2-4 summarises the trend at this site. The SPA has been classified by NatureScot as being in 'Favourable' condition.

Figure 2-4. Westwater annual peak counts, 1965/66 – 2021/22



Note: the line shows the General Additive Model (GAM) line of best fit with standard error.

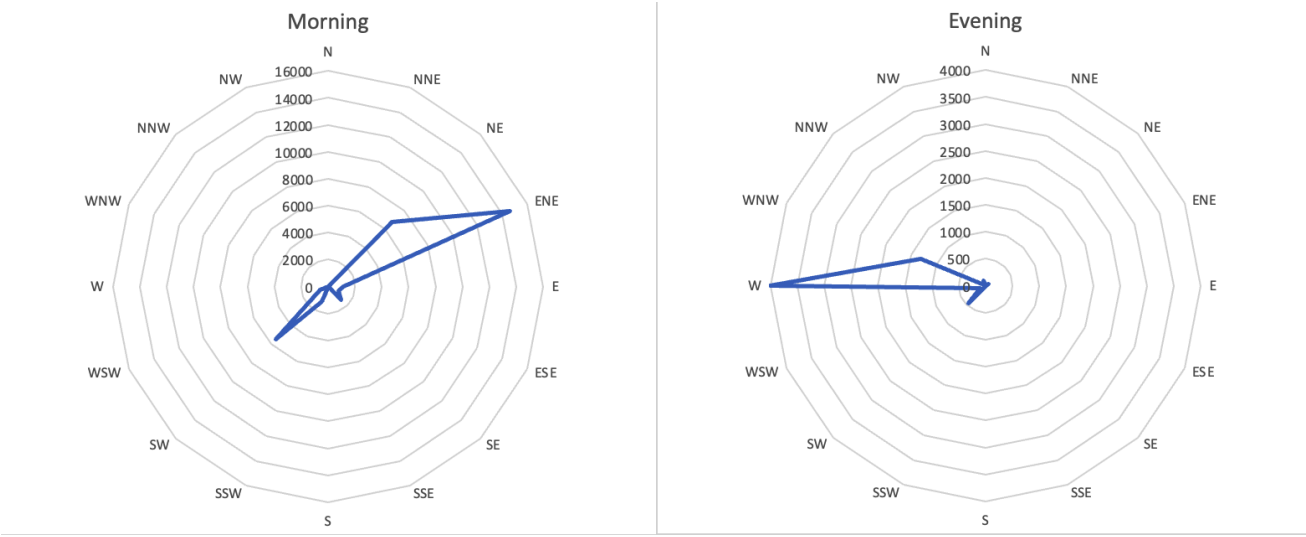
APPORTIONING IMPACTS BETWEEN SPAS

35. The data presented above on the SPA population trends through time illustrate the highly dynamic nature of the pink-footed goose populations in the region. Whilst some SPA populations have declined (notably on Gladhosue Reservoir), others have increased over the same time period, suggesting that birds are switching roosts, a characteristic behaviour of wintering pink-footed geese (Fox *et al*. 1994). Rather than being faithful to one particular SPA within and between winters, these geese appear to regularly move between sites.

36. The closest SPA to the Proposed Development Is Gladhouse Reservoir, so one would expect the majority of the geese to be using that SPA as a night roost. Whilst the recent monitoring data would suggest that is not the case (with a recent 5-year mean peak of only 85), data from the project baseline surveys have shown that much higher numbers are currently roosting on the reservoir.

37. Analysis of the flight directions of morning and evening flights from the baseline Vantage Point (VP) data showed that most flights are to/from Gladhouse Reservoir (Figure 2-5). Birds tended to head out east from the reservoir in the morning and return in a westerly directly to roost there at night.

Figure 2-5. Direction of morning and evening pink-footed goose roost flights observed during site VP surveys.



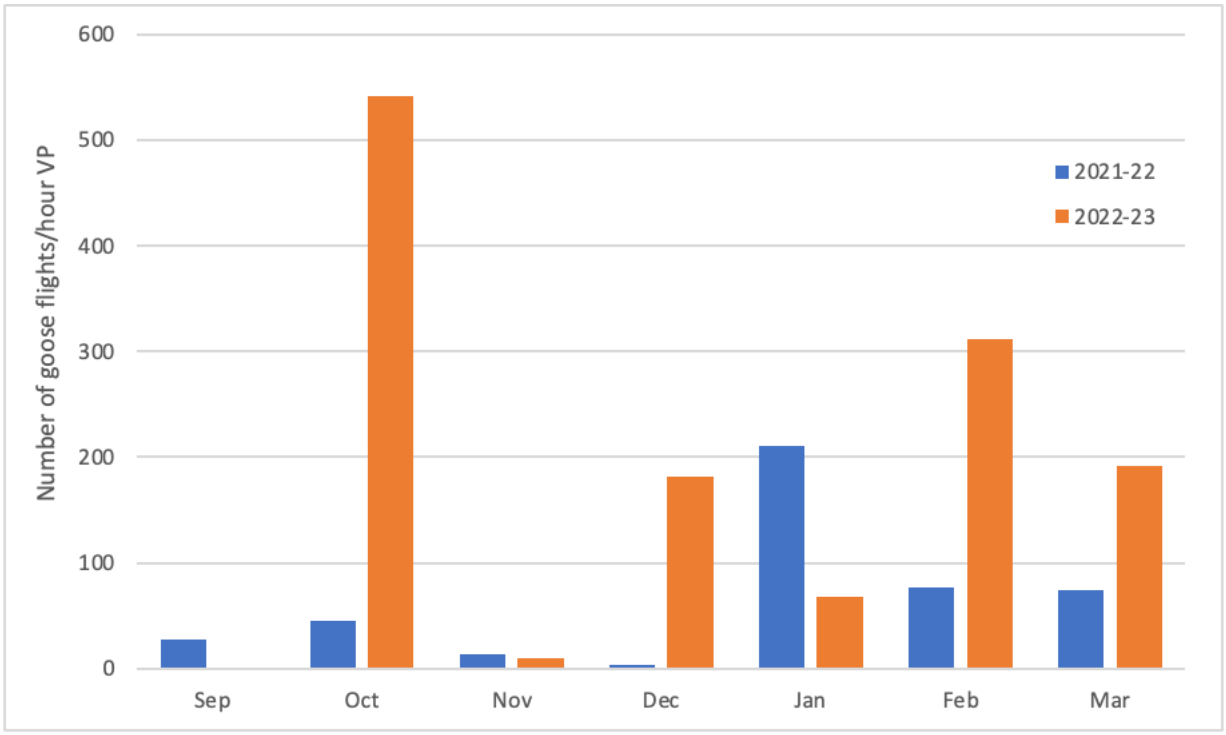
38. There were, however, a smaller number of pink-footed goose flights observed heading in the directions of Fala Flow SPA and Aberlady Bay (which forms part of the Firth of Forth SPA), so there is some ecological linkage with those SPAs too. Some connectivity with the Westwater SPA also cannot be ruled out.

39. Given the dynamic nature of the regional pink-footed goose populations, this assessment has examined potential effects on both the closest SPA, Gladhouse Reservoir (for which there is clearly a strong ecological link with birds using the site regularly roosting on the SPA at night), and on the three other more distant SPAs that could still have some ecological linkage with the Proposed Development site.

COLLISION RISK

40. Pink-footed goose flights were observed flying through the collision risk regularly through both of the baseline survey winters. Observed flight rates are summarised in Figure 2-3.

Figure 2-6. Pink-footed goose flight rates through the collision risk zone at rotor height, 2021-22 and 2022-23.



41. The collision risk predictions from the model for pink-footed geese were summarised in Table 1-5 above, applying the NS-recommended precautionary 99.8% avoidance rate (SNH 2018) gave a predicted collision risk of 8.7 geese per year based on the 2012-22 data and 19.3 based on the 2022-23 data, which combined gives an overall predicted risk of 14.0 goose collisions per year.

42. Usually, the predicted collision risk would be expressed as a percentage increase in the baseline mortality of the SPA pink-footed goose population. The geese using the potential impact zone were most strongly linked to the Gladhouse Reservoir SPA. However, the monitoring data available for that SPA do not provide an appropriate baseline. The five-year mean peak count is only 85 birds, whilst the baseline surveys show that there were regularly over 2,000 geese roosting on the reservoir.

43. Evidence from existing wind farms would suggest that the actual number of collisions would be less than the model predictions. Two studies at wind farms in the UK both reported empirical avoidance rates of 99.99% (only single dead geese being recorded at both sites over four years of surveys at each, Percival *et al*. 2020a, Percival *et al*. 2020b). A study in Denmark also reported a higher avoidance rate of 99.9% (Drachman *et al*. 2020).

44. Applying the NS precautionary avoidance rate, 14.0 pink-footed goose collisions/year were predicted. This number would be negligible in the context of the background population mortality, given the background annual mortality rate of 17%, extensive shooting mortality and increasing population trend (doubling since 1995/96, Austin *et al.* 2023).

45. Furthermore, the actual number of collisions is likely to be less, given the results of the post-construction monitoring set out above. Applying a more realistic 99.99% avoidance would reduce the risk to only 1-2 collisions per year. This provides additional confidence that collision risk would not result in an adverse effect on the integrity of any SPA.

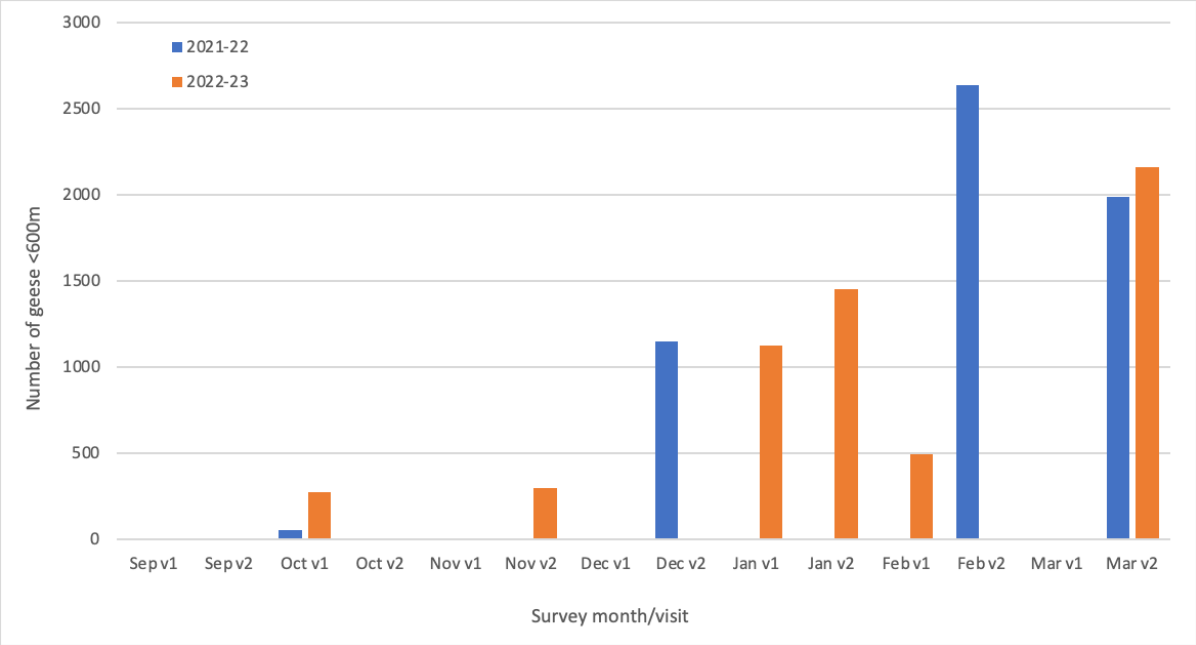
46. In conclusion, the collision risk would be only a negligible magnitude effect that would not result in any adverse effect on the integrity of any SPA population.

DISTURBANCE – CONSTRUCTION

47. A precautionary 600 m buffer from the Proposed Development infrastructure has been used to define the potential disturbance zone during construction. Pink-footed goose feeding flocks were regularly seen in the fields to the east of the Proposed Development, and some of these fields are within the potential impact zone during construction. The numbers recorded in that zone during each survey are shown in Figure 2-7.

48. Fifteen flocks were recorded within this zone over the two baseline winters. The peak count within the zone was 2,635, with a mean of 413. Geese were present on 10 of the 28 surveys. They were mostly (65% flocks) feeding on grass pastures, with some records on winter wheat and stubble. Figure 2-7 summarises the count totals within the 600m zone on each survey visit, showing the high variability in the numbers present.

Figure 2-7. Pink-footed goose totals within the 600m zone around the Proposed Development.



49. The total area of goose feeding fields within the 600 m zone was 0.49 km^2, the equivalent of only about 0.1% of the range (assuming a 15km core range, SNH 2016). There would only be a short-term loss of this area through the construction period. Temporary loss of a very small proportion of the range of such a dynamic species would result in no adverse effect on the integrity of any SPA.

DISTURBANCE – OPERATION

50. Only a single pink-footed goose flock was recorded on the ground within the feeding fields in the potential operational disturbance zone (within 600 m of the wind turbines) over the two winters of baseline survey – a flock of 1,125 seen just to the east of the site on 3/1/23, 600 m from the nearest proposed wind turbine.

51. Furthermore, the 600 m distance from the turbines is a precautionary worst case, and empirical evidence from existing wind farms would suggest this zone would be smaller. Larsen and Madsen (2000) reported displacement of 1-200 m, and Madsen and Boertmann (2010) found that this distance reduced over time as

pink-footed geese habituated to the presence of the turbines. Recent post-construction monitoring in the UK reported a similar scale of displacement of pink-footed geese (within 200 m) of the wind turbines at the Goole Fields wind farm (Percival *et al.* 2020b).

52. Overall, any disturbance effect during operation would be negligible and would result in no adverse effect on the integrity of any SPA.

OVERALL CONCLUSIONS

53. Standardised modelling predicted pink-footed goose collision risk to be of negligible magnitude (19 collisions per year). Evidence from existing wind farms with pink-footed geese suggests that this may overestimate the risk and that the actual number of collisions may be as low as 1-2 per year. Collision risk would result in no adverse effect on the integrity of any SPA.

54. Disturbance during construction has the potential to affect pink-footed goose feeding fields that would be ecologically linked to the Gladhouse Reservoir SPA. However, temporary loss of a very small proportion of the range of such a dynamic species would result in no adverse effect on the integrity of any SPA.

55. Pink-footed geese made only very infrequent use of the potential disturbance zone of the operational wind farm. Only a single flock was observed feeding there during the baseline surveys, 600 m from the nearest proposed wind turbine. Given this low level of use and the fact that the disturbance distance is likely to be smaller (up to 200 m, given the results of studies from existing wind farms), this would result in no adverse effect on the integrity of any SPA.

56. Therefore, the Proposed Development would have no adverse effect on the integrity of any SPA.

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