

## ANNEX E COLLISION RISK ASSESSMENTS

Table E-1, Table E-2 and Table E-3 present the parameters which apply to each Collision Risk Model (CRM).

**Table E-1 Wind farm parameters**

|   |           |                        |
|---|-----------|------------------------|
| Size of Collision Risk Analysis Area (CRAA) | 295.55    | hectares (ha)          |
| Number of turbines                          | 13        | turbines               |
| Rotor diameter                              | 132       | metres (m)             |
| Hub height                                  | 85        | m                      |
| Max. rotor depth                            | 1.1647    | m (at 15° pitch angle) |
| Max. chord                                  | 4.5       | m                      |
| Pitch                                       | 15        | degrees (°)            |
| Rotation period                             | 4.8       | seconds (secs)         |
| Turbine operation time                      | 85        | percent (%)            |
| Risk height: lowest                         | 19        | m                      |
| Rick height: highest                        | 151       | m                      |
| Flight risk volume                          | 390132590 | m <sup>3</sup>         |

**Table E-2 CRM parameters per species**

| Species           | Length (m) | Wingspan (m) | Assumed flight speed, v (ms <sup>-1</sup> ) | Avoidance rate | Probability of collision | Bird transit time (secs) |
|-------------------|------------|--------------|---|----------------|--------------------------|--------------------------|
| Common sandpiper  | 0.21       | 0.41         | 9.1   | 0.98           | 0.0679                   | 0.1511                   |
| Curlew            | 0.6        | 1            | 13  | 0.98           | 0.0742                   | 0.1357                   |
| Greylag goose     | 0.825      | 1.635        | 17.1  | 0.998          | 0.0746                   | 0.1164                   |
| Hen harrier       | 0.48       | 1.1          | 12  | 0.99           | 0.0725                   | 0.1371                   |
| Lapwing           | 0.31       | 0.87         | 11.9  | 0.98           | 0.0640                   | 0.1239                   |
| Osprey            | 0.58       | 1.7          | 11.4  | 0.98           | 0.0822                   | 0.1530                   |
| Merlin            | 0.28       | 0.56         | 13  | 0.98           | 0.0585                   | 0.1111                   |
| Oystercatcher     | 0.45       | 0.86         | 13  | 0.98           | 0.0670                   | 0.1242                   |
| Peregrine         | 0.48       | 1.1          | 12.1  | 0.98           | 0.0721                   | 0.1359                   |
| Pink-footed goose | 0.675      | 1.252        | 17.3  | 0.998          | 0.0692                   | 0.1063                   |
| Snipe             | 0.27       | 0.47         | 17.1  | 0.98           | 0.0517                   | 0.0839                   |
| Whooper swan      | 1.525      | 2.305        | 17.3  | 0.98           | 0.0994                   | 0.1555                   |

**Table E-3 Visible area within the CRAA per vantage point**

| VP           | Area (ha) 14/15 | Area (ha) 09/10 |
|--------------|-----------------|-----------------|
| 1            | -               | 208.95          |
| 2            | 239.12          | 413.58          |
| 3            | 255.42          | 367.14          |
| <b>Total</b> | <b>494.55</b>   | <b>989.66</b>   |

Birds are assumed to be active during all daylight hours and this is estimated by calculating the number of hours per day between sunrise and sunset (adjusting for correct latitude) for the survey seasons as defined below:

- Breeding season (1<sup>st</sup> April to 31<sup>st</sup> August) – 2,438 hours
- Non-breeding season (1<sup>st</sup> September to 31<sup>st</sup> March) – 2,058 hours

Outputs for the CRM for the following species are presented in the following order below:

- Common sandpiper;
- Curlew;
- Greylag goose;
- Hen harrier;
- Lapwing;
- Merlin;
- Osprey;
- Oystercatcher;
- Peregrine;
- Pink-footed goose;
- Snipe; and
- Whooper swan.

**E.1 Common Sandpiper**

Breeding Season 2015

**Table E-4 Common sandpiper flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 0.00                   | 14108.2571                | 0  |
| 3  | 5.53                   | 13792.8422                | 5.5071E-08   |

**Table E-5 Common sandpiper mortality estimates**

|   |            |                  |
|---|------------|------------------|
| Mean activity in wind farm at rotor height          | 1.6277E-05 | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 244559     | m <sup>3</sup>   |
| Bird occupancy                                      | 0.0397     | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.0895     | bird-sec         |
| No. of transits through rotors                      | 0.5927     | per season       |
| Estimated collisions                                | 0.0403     | per season       |
| Estimated collisions after correction for operation | 0.0342     | per season       |
| Estimated collisions after avoidance factor         | 0.0007     | per season       |
| Equivalent to 1 bird every                          | 1460.55    | seasons          |

**E.2 Curlew**

Breeding Season 2010

**Table E-6 Curlew flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 1  | 0.00                   | 12745.65                  | 0  |
| 2  | 675.00                 | 25228.32                  | 3.16361E-06  |
| 3  | 30.00                  | 21293.89                  | 1.40604E-07  |

**Table E-7 Curlew mortality estimates**

|   |           |                  |
|---|-----------|------------------|
| Mean activity in wind farm at rotor height          | 0.002     | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 313941.31 | m <sup>3</sup>   |
| Bird occupancy                                      | 4.83      | hrs/season       |
| Bird occupancy of rotor swept volume                | 6.90      | bird-sec         |
| No. of transits through rotors                      | 50.80     | per season       |
| Estimated collisions                                | 3.77      | per season       |
| Estimated collisions after correction for operation | 3.20      | per season       |
| Estimated collisions after avoidance factor         | 0.0641    | per season       |
| Equivalent to 1 bird every                          | 15.608    | seasons          |

## Non-Breeding Season 2014/2015

**Table E-8 Curlew flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 215.97                 | 19966.7706                | 1.4499E-06   |
| 3  | 291.69                 | 21409.5562                | 1.9582E-06   |

**Table E-9 Curlew mortality estimates**

|   |         |                  |
|---|---------|------------------|
| Mean activity in wind farm at rotor height          | 0.0010  | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 313941  | m <sup>3</sup>   |
| Bird occupancy                                      | 2.0732  | hrs/season       |
| Bird occupancy of rotor swept volume                | 6.0060  | bird-sec         |
| No. of transits through rotors                      | 44.2449 | per season       |
| Estimated collisions                                | 3.2823  | per season       |
| Estimated collisions after correction for operation | 2.7899  | per season       |
| Estimated collisions after avoidance factor         | 0.0558  | per season       |
| Equivalent to 1 bird every                          | 17.92   | seasons          |

## Breeding Season 2015

**Table E-10 Curlew flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 104.34                 | 14108.2571                | 1.0388E-06   |
| 3  | 176.92                 | 13792.8422                | 1.7614E-06   |

**Table E-11 Curlew mortality estimates**

|   |         |                  |
|---|---------|------------------|
| Mean activity in wind farm at rotor height          | 0.0008  | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 313941  | m <sup>3</sup>   |
| Bird occupancy                                      | 2.0174  | hrs/season       |
| Bird occupancy of rotor swept volume                | 5.8444  | bird-sec         |
| No. of transits through rotors                      | 43.0539 | per season       |
| Estimated collisions                                | 3.1939  | per season       |
| Estimated collisions after correction for operation | 2.7148  | per season       |
| Estimated collisions after avoidance factor         | 0.0543  | per season       |
| Equivalent to 1 bird every                          | 18.42   | seasons          |

**E.3 Greylag goose****Breeding Season 2010****Table E-12 Greylag goose flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 1  | 0.00                   | 12745.64                  | 0  |
| 2  | 60.00                  | 25228.32                  | 2.81209E-07  |
| 3  | 0.00                   | 21293.89                  | 0  |

**Table E-13 Greylag goose mortality estimates**

|   |            |                  |
|---|------------|------------------|
| Mean activity in wind farm at rotor height          | 0.0001     | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 353969.280 | m <sup>3</sup>   |
| Bird occupancy                                      | 0.411      | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.662      | bird-sec         |
| No. of transits through rotors                      | 5.687      | per season       |
| Estimated collisions                                | 0.424      | per season       |
| Estimated collisions after correction for operation | 0.360      | per season       |
| Estimated collisions after avoidance factor         | 0.0007     | per season       |
| Equivalent to 1 bird every                          | 1386.61    | seasons          |

**Non-Breeding Season 2014/2015****Table E-14 Greylag goose flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 10762.95               | 19966.7706                | 7.2257E-05   |
| 3  | 833.84                 | 21409.5562                | 5.5979E-06   |

**Table E-15 Greylag goose mortality estimates**

|   |           |                  |
|---|-----------|------------------|
| Mean activity in wind farm at rotor height          | 0.0230    | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 353969    | m <sup>3</sup>   |
| Bird occupancy                                      | 47.3601   | hrs/season       |
| Bird occupancy of rotor swept volume                | 154.6922  | bird-sec         |
| No. of transits through rotors                      | 1329.4750 | per season       |
| Estimated collisions                                | 99.1659   | per season       |
| Estimated collisions after correction for operation | 84.2910   | per season       |
| Estimated collisions after avoidance factor         | 0.1686    | per season       |
| Equivalent to 1 bird every                          | 5.93      | seasons          |

**Breeding Season 2015****Table E-16 Greylag goose flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 677.98                 | 14108.2571                | 6.7498E-06   |
| 3  | 484.43                 | 13792.8422                | 4.8228E-06   |

**Table E-17 Greylag goose mortality estimates**

|   |          |                  |
|---|----------|------------------|
| Mean activity in wind farm at rotor height          | 0.0034   | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 353969   | m <sup>3</sup>   |
| Bird occupancy                                      | 8.3378   | hrs/season       |
| Bird occupancy of rotor swept volume                | 27.2337  | bird-sec         |
| No. of transits through rotors                      | 234.0555 | per season       |
| Estimated collisions                                | 17.4583  | per season       |
| Estimated collisions after correction for operation | 14.8395  | per season       |
| Estimated collisions after avoidance factor         | 0.0297   | per season       |
| Equivalent to 1 bird every                          | 33.69    | seasons          |

**E.4 Hen Harrier****Non-Breeding Season 2014/2015****Table E-18 Hen harrier flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 1885.14                | 19966.7706                | 1.2656E-05   |
| 3  | 407.45                 | 21409.5562                | 2.7354E-06   |

**Table E-19 Hen harrier mortality estimates**

|   |          |                  |
|---|----------|------------------|
| Mean activity in wind farm at rotor height          | 0.0045   | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 292593   | m <sup>3</sup>   |
| Bird occupancy                                      | 9.3627   | hrs/season       |
| Bird occupancy of rotor swept volume                | 25.2787  | bird-sec         |
| No. of transits through rotors                      | 184.4394 | per season       |
| Estimated collisions                                | 13.3657  | per season       |
| Estimated collisions after correction for operation | 11.3608  | per season       |
| Estimated collisions after avoidance factor         | 0.1136   | per season       |
| Equivalent to 1 bird every                          | 8.80     | seasons          |

**Breeding Season 2015****Table E-20 Hen harrier flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 0.00                   | 14108.2571                | 0.0000   |
| 3  | 135.96                 | 13792.8422                | 1.3536E-06   |

**Table E-21 Hen harrier mortality estimates**

|   |         |                  |
|---|---------|------------------|
| Mean activity in wind farm at rotor height          | 0.0004  | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 292593  | m <sup>3</sup>   |
| Bird occupancy                                      | 0.9753  | hrs/season       |
| Bird occupancy of rotor swept volume                | 2.6331  | bird-sec         |
| No. of transits through rotors                      | 19.2119 | per season       |
| Estimated collisions                                | 1.3922  | per season       |
| Estimated collisions after correction for operation | 1.1834  | per season       |
| Estimated collisions after avoidance factor         | 0.0118  | per season       |
| Equivalent to 1 bird every                          | 84.50   | seasons          |

**E.5 Lapwing****Breeding Season 2010****Table E-22 Lapwing flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 1  | 0.00                   | 12745.64545               | 0  |
| 2  | 40.00                  | 25228.31961               | 1.87473E-07  |
| 3  | 0.00                   | 21293.88721               | 0  |

**Table E-23 Lapwing mortality estimates**

|   |          |                  |
|---|----------|------------------|
| Mean activity in wind farm at rotor height          | 0.0001   | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 262349.7 | m <sup>3</sup>   |
| Bird occupancy                                      | 0.274    | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.327    | bird-sec         |
| No. of transits through rotors                      | 2.639    | per season       |
| Estimated collisions                                | 0.169    | per season       |
| Estimated collisions after correction for operation | 0.143    | per season       |
| Estimated collisions after avoidance factor         | 0.0029   | per season       |
| Equivalent to 1 bird every                          | 348.344  | seasons          |

**Non-Breeding Season 2014/2015****Table E-24 Lapwing flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 87.86                  | 19966.7706                | 5.8982E-07   |
| 3  | 0.00                   | 21409.5562                | 0.0000   |

**Table E-25 Lapwing mortality estimates**

|   |        |                  |
|---|--------|------------------|
| Mean activity in wind farm at rotor height          | 0.0002 | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 262350 | m <sup>3</sup>   |
| Bird occupancy                                      | 0.3588 | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.8686 | bird-sec         |
| No. of transits through rotors                      | 7.0092 | per season       |
| Estimated collisions                                | 0.4486 | per season       |
| Estimated collisions after correction for operation | 0.3813 | per season       |
| Estimated collisions after avoidance factor         | 0.0076 | per season       |
| Equivalent to 1 bird every                          | 131.13 | seasons          |

**Breeding Season 2015****Table E-26 Lapwing flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 135.10                 | 14108.2571                | 1.3450E-06   |
| 3  | 0.00                   | 13792.8422                | 0.0000   |

**Table E-27 Lapwing mortality estimates**

|   |         |                  |
|---|---------|------------------|
| Mean activity in wind farm at rotor height          | 0.0004  | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 262350  | m <sup>3</sup>   |
| Bird occupancy                                      | 0.9691  | hrs/season       |
| Bird occupancy of rotor swept volume                | 2.3459  | bird-sec         |
| No. of transits through rotors                      | 18.9307 | per season       |
| Estimated collisions                                | 1.2115  | per season       |
| Estimated collisions after correction for operation | 1.0298  | per season       |
| Estimated collisions after avoidance factor         | 0.0206  | per season       |
| Equivalent to 1 bird every                          | 48.55   | seasons          |

## E.6 Merlin

### Breeding Season 2010

**Table E-28 Merlin flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 1  | 0                      | 12745.64545               | 0  |
| 2  | 60.00001796            | 25228.31961               | 2.81209E-07  |
| 3  | 0                      | 21293.88721               | 0  |

**Table E-29 Merlin mortality estimates**

|   |           |                  |
|---|-----------|------------------|
| Mean activity in wind farm at rotor height          | 0.0001687 | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 257012.63 | m <sup>3</sup>   |
| Bird occupancy                                      | 0.411     | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.480     | bird-sec         |
| No. of transits through rotors                      | 4.324     | per season       |
| Estimated collisions                                | 0.253     | per season       |
| Estimated collisions after correction for operation | 0.215     | per season       |
| Estimated collisions after avoidance factor         | 0.0043    | per season       |
| Equivalent to 1 bird every                          | 232.47    | seasons          |

### Non-Breeding Season 2014/2015

**Table E-30 Merlin flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 16.59                  | 19966.7706                | 1.1141E-07   |
| 3  | 0.00                   | 21409.5562                | 0.0000   |

**Table E-31 Merlin mortality estimates**

|  |            |                  |
|--|------------|------------------|
| Mean activity in wind farm at rotor height | 3.2927E-05 | hr <sup>-1</sup> |
| Total Combined rotor swept volume          | 257013     | m <sup>3</sup>   |
| Bird occupancy                             | 0.0678     | hrs/season       |
| Bird occupancy of rotor swept volume       | 0.1607     | bird-sec         |
| No. of transits through rotors             | 1.4463     | per season       |



|   |        |            |
|---|--------|------------|
| Estimated collisions                                | 0.0846 | per season |
| Estimated collisions after correction for operation | 0.0719 | per season |
| Estimated collisions after avoidance factor         | 0.0014 | per season |
| Equivalent to 1 bird every                          | 694.97 | seasons    |

## E.7 Osprey

Breeding Season 2010

**Table E-32 Osprey flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 1  | 0.00                   | 12745.6454                | 0.0000   |
| 2  | 258.48                 | 22395.2952                | 1.2143E-06   |
| 3  | 0.00                   | 23987.5826                | 0.0000   |

**Table E-33 Osprey mortality estimates**

|   |         |                  |
|---|---------|------------------|
| Mean activity in wind farm at rotor height          | 0.0007  | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 310383  | m <sup>3</sup>   |
| Bird occupancy                                      | 1.7753  | hrs/season       |
| Bird occupancy of rotor swept volume                | 2.5058  | bird-sec         |
| No. of transits through rotors                      | 16.3730 | per season       |
| Estimated collisions                                | 1.3455  | per season       |
| Estimated collisions after correction for operation | 1.1436  | per season       |
| Estimated collisions after avoidance factor         | 0.0229  | per season       |
| Equivalent to 1 bird every                          | 43.72   | seasons          |

## E.8 Oystercatcher

Non-Breeding Season 2014/2015

**Table E-34 Oystercatcher flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 15.41                  | 19966.7706                | 1.0342E-07   |
| 3  | 0.00                   | 21409.5562                | 0.0000   |

**Table E-35 Oystercatcher mortality estimates**

|   |            |                  |
|---|------------|------------------|
| Mean activity in wind farm at rotor height          | 3.0567E-05 | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 287256     | m <sup>3</sup>   |
| Bird occupancy                                      | 0.0629     | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.1668     | bird-sec         |
| No. of transits through rotors                      | 1.3426     | per season       |
| Estimated collisions                                | 0.0900     | per season       |
| Estimated collisions after correction for operation | 0.0765     | per season       |
| Estimated collisions after avoidance factor         | 0.0015     | per season       |
| Equivalent to 1 bird every                          | 653.47     | seasons          |

## Breeding Season 2015

**Table E-36 Oystercatcher flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 13.29                  | 14108.2571                | 1.3229E-07   |
| 3  | 0.00                   | 13792.8422                | 0.0000   |

**Table E-37 Oystercatcher mortality estimates**

|   |            |                  |
|---|------------|------------------|
| Mean activity in wind farm at rotor height          | 3.9098E-05 | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 287256     | m <sup>3</sup>   |
| Bird occupancy                                      | 0.0953     | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.2526     | bird-sec         |
| No. of transits through rotors                      | 2.0340     | per season       |
| Estimated collisions                                | 0.1364     | per season       |
| Estimated collisions after correction for operation | 0.1159     | per season       |
| Estimated collisions after avoidance factor         | 0.0023     | per season       |
| Equivalent to 1 bird every                          | 431.36     | seasons          |

**E.9 Peregrine**

## Non-Breeding Season 2010/2011

**Table E-38 Peregrine flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 1  | 0                      | 5432.57019                | 0  |
| 2  | 30.00                  | 11580.21228               | 2.97333E-07  |
| 3  | 0                      | 11014.07959               | 0  |

**Table E-39 Peregrine mortality estimates**

|   |           |                  |
|---|-----------|------------------|
| Mean activity in wind farm at rotor height          | 0.0002    | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 292593.05 | m <sup>3</sup>   |
| Bird occupancy                                      | 0.377     | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.488     | bird-sec         |
| No. of transits through rotors                      | 3.593     | per season       |
| Estimated collisions                                | 0.259     | per season       |
| Estimated collisions after correction for operation | 0.220     | per season       |
| Estimated collisions after avoidance factor         | 0.004     | per season       |
| Equivalent to 1 bird every                          | 227.075   | seasons          |

**E.10 Pink-footed Goose**

Non-Breeding Season 2014/2015

**Table E-40 Pink-footed goose flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 12217.61               | 19966.7706                | 8.2022E-05   |
| 3  | 3754.85                | 21409.5562                | 2.5208E-05   |

**Table E-41 Pink-footed goose mortality estimates**

|   |           |                  |
|---|-----------|------------------|
| Mean activity in wind farm at rotor height          | 0.0317    | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 327284    | m <sup>3</sup>   |
| Bird occupancy                                      | 65.2299   | hrs/season       |
| Bird occupancy of rotor swept volume                | 196.9979  | bird-sec         |
| No. of transits through rotors                      | 1852.5246 | per season       |
| Estimated collisions                                | 128.1499  | per season       |
| Estimated collisions after correction for operation | 108.9274  | per season       |
| Estimated collisions after avoidance factor         | 0.2179    | per season       |
| Equivalent to 1 bird every                          | 4.59      | seasons          |

Breeding Season 2015

**Table E-42 Pink-footed goose flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 0.00                   | 14108.2571                | 0.0000   |
| 3  | 1511.16                | 13792.8422                | 1.5045E-05   |

**Table E-43 Pink-footed goose mortality estimates**

|   |          |                  |
|---|----------|------------------|
| Mean activity in wind farm at rotor height          | 0.0044   | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 327284   | m <sup>3</sup>   |
| Bird occupancy                                      | 10.8393  | hrs/season       |
| Bird occupancy of rotor swept volume                | 32.7354  | bird-sec         |
| No. of transits through rotors                      | 307.8368 | per season       |
| Estimated collisions                                | 21.2949  | per season       |
| Estimated collisions after correction for operation | 18.1006  | per season       |
| Estimated collisions after avoidance factor         | 0.0362   | per season       |
| Equivalent to 1 bird every                          | 27.62    | seasons          |

**E.11 Snipe****Non-Breeding Season 2009/2010****Table E-44 Snipe flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 1  | 4.97                   | 5850.4602                 | 5.1983E-08   |
| 2  | 0.00                   | 9545.5356                 | 0.0000   |
| 3  | 0.00                   | 11166.6333                | 0.0000   |

**Table E-45 Snipe mortality estimates**

|   |           |                  |
|---|-----------|------------------|
| Mean activity in wind farm at rotor height          | 3.123E-05 | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 255233.61 | m <sup>3</sup>   |
| Bird occupancy                                      | 0.0643    | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.0746    | bird-sec         |
| No. of transits through rotors                      | 0.889     | per season       |
| Estimated collisions                                | 0.0460    | per season       |
| Estimated collisions after correction for operation | 0.039     | per season       |
| Estimated collisions after avoidance factor         | 0.0008    | per season       |
| Equivalent to 1 bird every                          | 1279.976  | seasons          |

**Non-Breeding Season 2014/2015****Table E-46 Snipe flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 10.13                  | 19966.7706                | 6.8030E-08   |
| 3  | 81.33                  | 21409.5562                | 5.4599E-07   |

**Table E-47 Snipe mortality estimates**

|   |         |                  |
|---|---------|------------------|
| Mean activity in wind farm at rotor height          | 0.0002  | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 255234  | m <sup>3</sup>   |
| Bird occupancy                                      | 0.3735  | hrs/season       |
| Bird occupancy of rotor swept volume                | 0.8797  | bird-sec         |
| No. of transits through rotors                      | 10.4852 | per season       |
| Estimated collisions                                | 0.5419  | per season       |
| Estimated collisions after correction for operation | 0.4606  | per season       |
| Estimated collisions after avoidance factor         | 0.0092  | per season       |
| Equivalent to 1 bird every                          | 108.55  | seasons          |

## Breeding Season 2015

**Table E-48 Snipe flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 0.00                   | 14108.2571                | 0.0000   |
| 3  | 502.93                 | 13792.8422                | 5.0071E-06   |

**Table E-49 Snipe mortality estimates**

|   |          |                  |
|---|----------|------------------|
| Mean activity in wind farm at rotor height          | 0.0015   | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 255234   | m <sup>3</sup>   |
| Bird occupancy                                      | 3.6074   | hrs/season       |
| Bird occupancy of rotor swept volume                | 8.4963   | bird-sec         |
| No. of transits through rotors                      | 101.2669 | per season       |
| Estimated collisions                                | 5.2336   | per season       |
| Estimated collisions after correction for operation | 4.4486   | per season       |
| Estimated collisions after avoidance factor         | 0.0890   | per season       |
| Equivalent to 1 bird every                          | 11.24    | seasons          |

**E.12 Whooper Swan**

## Non-Breeding Season 2014/2015

**Table E-50 Whooper swan flight activity**

| VP | Seconds at risk height | Observation effort (HaHr) | Flying time at risk height (secsHahr <sup>-1</sup> ) |
|----|------------------------|---------------------------|--|
| 2  | 31.06                  | 19966.7706                | 2.0850E-07   |
| 3  | 34.82                  | 21409.5562                | 2.3377E-07   |

**Table E-51 Whooper swan mortality estimates**

|   |        |                  |
|---|--------|------------------|
| Mean activity in wind farm at rotor height          | 0.0001 | hr <sup>-1</sup> |
| Total Combined rotor swept volume                   | 478501 | m <sup>3</sup>   |
| Bird occupancy                                      | 0.2690 | hrs/season       |
| Bird occupancy of rotor swept volume                | 1.1879 | bird-sec         |
| No. of transits through rotors                      | 7.6408 | per season       |
| Estimated collisions                                | 0.7593 | per season       |
| Estimated collisions after correction for operation | 0.6454 | per season       |
| Estimated collisions after avoidance factor         | 0.0129 | per season       |
| Equivalent to 1 bird every                          | 77.47  | seasons          |