



Appendix A10.11 – Deer

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Contents

1	Introduction	1
1.1	Proposed Scheme	1
1.2	Deer Biology	2
1.3	Legal Status	2
1.4	Risks to Road Traffic.....	3
2	Methods	3
2.1	Previous survey information	3
2.2	Deer Assessment Methods.....	3
2.3	Evaluation of Deer Activity	4
2.4	Risk Assessment	4
3	Baseline	5
3.1	Data search.....	5
3.2	Survey Results.....	5
4	Evaluation	7
5	Risk Assessment	8
5.1	Introduction	8
6	Mitigation	10
6.1	Generic Mitigation	10
7	References.....	12

Annex 1

Deer Collision Records Supplied by Grampian Police Control and Aberdeenshire Council Roads Department for 2003 – 2004

1 Introduction

1.1 Proposed Scheme

1.1.1 This Appendix reports the assessment of potential impacts on deer populations in the vicinity of the Northern Leg of the proposed scheme, supporting Chapter 10 (Ecology and Nature Conservation).

1.1.2 To aid the interpretation of the assessment, the AWPR Northern Leg study area has been divided into five route sections as follows:

- Section NL1 ch314800 – 316000 (Derbeth to Tulloch Road);
- Section NL2 ch316000 – 317400 (SAC Craibstone);
- Section NL3 ch317400 – 322600 (A96 to Nether Kirkton);
- Section NL4 ch322600 – 325370 (Nether Kirkton to Corsehill); and
- Section NL5 ch325370 – 331000 (Corsehill to Blackdog).

Studies on deer were included as part of the Ecological Impact Assessment (EclA), and were undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) Volumes 10 and 11 and the Environment Impact Assessment (Scotland) Regulations 1999. Deer do not have any specific legal protection for nature conservation and although the surveys and assessment is reported in this Appendix, no ecological impact assessment has been undertaken. This Appendix instead adopts a risk-assessment based approach as described below, which identifies key areas where there is a risk of deer/vehicle collisions. The data on deer have been included in the context of a potential traffic hazard associated with the proposed scheme, rather than because of their nature conservation value.

1.1.3 These studies included desk-based consultation to collate existing information about deer in the area potentially affected by the proposed scheme, and incidental observations collected during other ecological field surveys undertaken in 2004 and 2006 to provide current data about the status of deer populations.

1.1.4 For the purpose of this report, the study area is defined as comprising all areas within 500m of the centreline of the proposed scheme.

Aims

1.1.5 Road traffic accidents (RTAs) involving deer are a historic problem on British roads, known to cause approximately 300 human personal injury accidents and a number of human fatalities every year (Langbein and Putman 2005). The cost to the Scottish economy of deer related RTAs has been estimated as £5 million in human injuries annually with a further £1 million in vehicle damage (Putman et al., 2004).

1.1.6 Consequently, this assessment was designed to establish the relative magnitude and frequency of deer movement, and thus interaction with the proposed scheme. The impact of the proposed scheme on deer welfare is also considered, and as such, the survey aims were to:

- determine the presence, distribution and activity levels of deer;
- identify areas of likely, frequent deer movement;
- identify any areas that could represent a high risk of deer collision to motorists; and
- assess the likely generic impacts of the proposed scheme on local deer populations.

Aberdeen Western Peripheral Route
Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

1.1.7 An assessment of collision risk, drawn from the results of the above aims, will help future development of appropriate detailed mitigation measures.

1.1.8 This report is presented in the following structure:

- an overview of the biology, legislative status and risks to traffic;
- a summary of previous survey information;
- survey and impact assessment methods;
- survey results and an evaluation of the levels of deer activity in a particular area;
- an assessment of the potential risk of roe deer to human road safety; and
- generic mitigation proposals to reduce this risk.

1.2 Deer Biology

1.2.1 Of the six species of deer established in the wild in Britain, two are native and four have been introduced.

1.2.2 Roe deer (*Capreolus capreolus*), a native species, was the only deer species recorded within the study area and therefore only the biology of this species will be discussed.

1.2.3 Roe deer stand on average 75cm high at the shoulder, with the larger bucks weighing up to approximately 32kg. They are widespread and common throughout Scotland and utilise a wide variety of habitats for lying up or feeding, including arable land, grassland, heathland, thick scrub, deciduous and coniferous woodland. Roe deer are selective browsers, their diet comprising buds, shoots, herbs, shrubs and fungi; they also graze on grasses (Deer UK, 2004). Mating occurs from mid July to August, and following delayed implantation 1-3 young are born in May or June the following year.

1.2.4 In summer, roe deer are usually solitary or occur in small groups consisting of a doe and her kids and sometimes a buck. Yearlings of both sexes may accumulate to form a non-territorial group with larger feeding aggregations of 10 - 30 individuals occurring in large fields during the winter. Home ranges vary widely between average sizes of 0.3 – 1.7km², the smallest ranges occurring in woodland landscapes and largest in farmland areas. Over-winter pre-breeding densities in the UK commonly vary from around 3 – 30 per km², with highest densities usually achieved in areas offering a high proportion of woodland cover (Langbein, 2004).

1.2.5 As ruminants, roe deer spend substantial periods of time feeding and 'lying-up.' These activities will often take place in distinct but spatially contiguous habitats offering different feeding and cover resources, necessitating movement between them. This generally follows a diurnal pattern with a greater proportion of feeding taking place during the hours of darkness or at dusk and dawn. Movement therefore predominately, but not exclusively, takes place around this time.

1.3 Legal Status

1.3.1 Roe deer in Britain are not threatened or declining and as such all legislation pertinent to this species relates to prevention of animal cruelty.

1.3.2 Under the Deer (Scotland) Act 1996, the Deer Commission for Scotland (DCS) has responsibilities to 'further the conservation, control and sustainable management of deer in Scotland and keep under review all matters, including their welfare, relating to deer' (Section 1(1)a). In addition, the DCS has powers to control deer where and when they pose a threat to public safety.

1.4 Risks to Road Traffic

- 1.4.1 A DCS scoping study identified road traffic accidents as one of the main concerns with respect to both deer welfare and public safety (DCS Annual Report, 1998-99).
- 1.4.2 Estimates provided to the Highways Agency suggest that for the UK, accident rates involving deer are between 20,000 and 42,000 per year with perhaps 20% of these occurring in Scotland (SGS Environment, 1998).
- 1.4.3 Records and statistics for roe deer in Scotland (Staines et al., 2001) show that the incidence of reported road traffic accidents (RTAs)¹ appear to be greater:
- within or close to woodland (over 90% of accidents);
 - during the hours of darkness between 8pm and midnight;
 - the months of May and June;
 - at dusk and dawn especially during autumn and winter, and;
 - on sections of road where speeds are habitually highest.

2 Methods

2.1 Previous survey information

- 2.1.1 A review of published and archived material was undertaken. The material included an initial report (Road traffic accidents and deer in Scotland; Staines et al., 2001), produced for the DCS. This report reviewed data actively sought from organisations, including regional police authorities, insurance companies, Forest Enterprise, deer management groups and county councils.

2.2 Deer Assessment Methods

- 2.2.1 Incidental sightings of deer and deer field signs were recorded by a team of Jacobs surveyors when conducting protected species and Phase 1 Habitat surveys. Incidental records were noted within an area 500m either side of the centreline of the proposed scheme (See Figures 10.10a-g). Most surveys were conducted during daylight hours and some during the early morning and late evening.
- 2.2.2 Incidental records included observations of field signs such as moulted hair, lair depressions, droppings, prints (slots) and tracks, together with any sightings of adult deer and kids.
- 2.2.3 The surveys were conducted over two seasons during a 15 week period between 24 March 2004 and 10 July 2004 and over a 25 week period between 14 February 2006 and 24 August 2006.
- 2.2.4 A further site survey was conducted on the 17-18 August 2004 by a specialist deer consultant (Dr Langbein) to help ground truth incidental deer records gathered during the 2004 survey season and to familiarise himself with the route corridor, local deer habitats and levels of deer activity.
- 2.2.5 Any deer road casualties were also recorded, and supplemented by additional deer collision records supplied by Dr Langbein, via the National Deer Collisions Project (see Annex 1 to this report).

¹ For this report RTAs refer to any deer related collision with road traffic and are sometimes referred to in literature as Deer Vehicle Collisions (DVCs).

2.3 Evaluation of Deer Activity

- 2.3.1 The evaluation of deer activity (relative within the study area) is based on the presence, frequency and distribution of deer sightings and incidence of field signs encountered in the local environment for each section within the route corridor. The proximity of wooded areas to the alignment considered suitable to provide lying-up habitat to a population of roe deer, was also evaluated.
- 2.3.2 The following criteria were used to evaluate habitat considered to be of importance/value to deer populations:
- High deer activity – an area that contains extensive woodland and abundant sightings of individuals and field signs.
 - Medium-high deer activity – an area that contains extensive woodland or scrub and a moderate level of deer sightings and/or field signs.
 - Medium deer activity – an area that contains extensive woodland or scrub together with either sightings of individuals or the presence of field signs.
 - Medium-low deer activity – an area that contains limited woodland together with sightings of individuals and/or a presence of field signs.
 - Low deer activity - an area that contains limited woodland and infrequent sightings of individuals or field signs.
- 2.3.3 This evaluation reflects the common and local status of roe deer in the study area and not their value in conservation terms. Therefore, an assessment of the magnitude and significance of impact on deer is not required, rather an assessment of the level of risk from RTAs to public safety and deer welfare.

2.4 Risk Assessment

- 2.4.1 An increased risk of RTAs may occur at sections of carriageway that sever or pass close to woodland and areas where there are medium to high levels of deer activity. In addition, increased risk is likely where the driver's line of sight is obstructed, such as in the immediate vicinity of earth works and/or where the road passes over the crests of hills.
- 2.4.2 The risk assessment assigns a level of magnitude to a particular area along the alignment of the proposed scheme. The magnitude of risk is based on the following parameters:
- where the proposed scheme severs woodland habitat;
 - the proximity of woodland and scrub to the proposed scheme;
 - the level of deer activity; and
 - obstruction of a driver's line of sight to deer that are in the immediate vicinity and on associated earth works of the proposed carriageway.
- 2.4.3 These parameters are combined to determine the level of risk using the following criteria:
- **High Risk** – Where the proposed scheme severs or crops woodland together with medium to high deer activity and/or potential obstruction to a drivers line of sight
 - **Medium Risk** – Where the proposed scheme passes within 100m of woodland/scrub together with a medium to high deer activity and/or potential obstruction to a drivers line of sight
 - **Low Risk** – Where the proposed scheme passes in excess of 100m but less than 300m of an area of woodland.

Aberdeen Western Peripheral Route
Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

- 2.4.4 The risk assessment will help formulate appropriate mitigation measures along the proposed scheme to reduce potential collision risk. The mitigation measures will be prioritised to identify high and low priority areas, depending on the level of potential risk to drivers using the carriageway and impacts on deer welfare.

3 Baseline

3.1 Data search

- 3.1.1 Records of deer related road traffic accidents in Scotland are under-reported as there is no expectation on individuals to report such accidents. Therefore, there is a lack of comprehensive studies relating to deer and road traffic accidents for Scotland.
- 3.1.2 Consultation was undertaken with Scottish Natural Heritage (SNH), North East Scotland Biological Records Centre (NESBReC) and Dr Langbein.
- 3.1.3 Dr Langbein is an independent consultant with 25 years experience of researching deer populations in the UK. He is currently project leader for the National Deer Collisions Project, which aims to compile a national database of deer related accidents and examine factors associated with the road environment, deer ecology and deer management.
- 3.1.4 Further consultation was undertaken with the Forestry Commission Regional Officer at Durriss in a meeting in 2004. Unfortunately no RTA information was available, but estimates of local roe deer populations were in excess of 120 in Kirkhill forest and approximately 100 individuals in Countesswells Wood. The Regional Officer also provided the information that 22 and 10 roe deer were culled in Kirkhill forest and Countesswells Wood respectively in 2003/04 (J. Langbein, pers. comm.). These figures show that even with existing deer management programs roe deer can occur in substantial numbers, even in areas where actual sightings did not necessarily portray this.
- 3.1.5 The DCS report (Road traffic accidents and deer in Scotland; Staines et al., 2001) was compiled from reviewed data supplied by several organisations. The quantity and quality of these data were highly variable. Only records that submitted a date, time and location were accepted for analysis. In total 724 records were acceptable in addition to an extra 230 from a previous study.
- 3.1.6 Results from this information revealed certain consequences of RTAs that include: deer mortality, human injuries and car damage. Also revealed were factors associated with RTAs that include: species of deer, season of year, time of day and road-side habitats.
- 3.1.7 Staines et al. (2001) highlighted the scarcity of reliable past information on numbers and locations of deer/vehicle collisions in Scotland. A nationwide study (The National Deer Collisions Database; www.deercollisions.co.uk) has since been launched with support from the Scottish Executive to research and collate as high a proportion of known deer/vehicle collisions as possible occurring between 2003 to 2005 inclusive. Preliminary information was requested from that project on any recent RTAs recorded up to end of 2004.
- 3.1.8 The results from the DCS report together with more recent information from the National Deer Collisions Project provided useful background information for identifying risk and the level of risk in areas along the route of the proposed scheme. The report also provided an informative guide to available and successful mitigation techniques that are presently in place on operational road schemes.

3.2 Survey Results

- 3.2.1 Roe deer were ubiquitous across the whole of the study area (see Table 1). One or more deer signs were present in every woodland, with lairs and droppings the most prolific field signs. One kid (juvenile deer), one small group of individuals and a family group were encountered during the

Aberdeen Western Peripheral Route
Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

survey period. The RTA records shown from Derbeth to Monument Wood (sections NL1-NL3), do not include data from Aberdeen City Council. As the entirety of these three sections are within the city boundary limits it is likely that these data under-record RTAs involving roe deer in these sections and are not directly comparable with most of Section NL4 and parts of Section NL5 of the route (that are in Aberdeenshire). A high proportion of the deer road casualty records from 2003 and 2004 (Annex 1) were in the vicinity of Sections NL4-NL5 from Littlejohn's Wood to Gourdieburn, with approximately 16% of separate incidents occurring on the B977, B997 and B999 between Goval Bridge and Gourdieburn (all occurred in Aberdeenshire).

Table 1 – Survey Results and RTAs (Recorded in 2003 and 2004)

Areas of Deer Habitat	OS Grid Reference	Deer Signs Encountered	Deer Sighting	Number of RTA records and distance from alignment
Kepplestone	NJ 865 093	Yes	Yes	n/a
Gough Burn Wood	NJ 865 097	Yes	Yes	n/a
Newhill's Wood	NJ 872 098	Yes	No	n/a
West Lodge Plantation	NJ 865 108	Yes	Yes	n/a
Craibstone (South)	NJ 872 102	Yes	No	n/a
Craibstone Arboretum	NJ 870 105	Yes	No	n/a
Craibstone (North)	NJ 869 107	Yes	Yes	n/a
Parkhead Wood	NJ 866 105	Yes	Yes	n/a
West Woods	NJ 862 107	Yes	No	n/a
Green Burn Wood	NJ 869 112	Yes	Yes	n/a
Chapelbrae Wood	NJ 864 115	Yes	No	n/a
Farburn Wood	NJ 862 126	Yes	No	n/a
Standingstones Wood	NJ 885 126	Yes	Yes	n/a
Kirkhill Forest	NJ 857 135	Yes	Yes	n/a
East Woodlands	NJ 857 143	Yes	No	n/a
Bogenjoss Burn Wood	NJ 859 145	Yes	No	n/a
Pitmedden House Wood	NJ 862 147	Yes	No	n/a
Monument Wood	NJ 864 144	Yes	No	n/a
Goval Wood	NJ 884 155	Yes	No	n/a
Goval Belt	NJ 891 153	Yes	Yes	n/a
Upper Tack	NJ 894 167	Yes	Yes	n/a
Skate Wood	NJ 898 148	Yes	No	Two records within 300m
Littlejohn's Wood	NJ 905 153	Yes	No	One record 100m
Corsehill Wood	NJ 904 149	Yes	No	One record 300m
Den Wood	NJ 905 147	Yes	No	n/a
Red Moss (West)	NJ 910 156	Yes	Yes	One record 150m
Red Moss (East)	NJ 921 154	Yes	No	n/a
Moss Belt	NJ 914 155	Yes	No	n/a
Lily Loch	NJ 921 146	Yes	Yes	n/a
Leuchlands Croft Plantation	NJ 927 146	Yes	No	n/a
Gourdieburn	NJ 935 153	No	Yes	One record 500m

4 Evaluation

4.1.1 The distribution and frequency of deer sightings and field signs from Derbeth to Monument Wood (Sections NL1-NL3) were sporadic (i.e. deer were not recorded in all areas of woodland). All areas of deer habitat surveyed showed at least medium-low levels of deer activity; most areas support medium-high to high activity levels (see Table 2). These include woodland areas west and northwest of Kingswells and south of Brimmond Hill (approximately 12ha); woodland areas south of the A96 at Craibstone; and Kirkhill Forest (approximately 110ha) inside the proposed scheme footprint. North of the River Don (in Sections NL4-NL5), the alignment passes through or near to less woodland compared with other sections, and thus activity levels are generally less. However some areas of extensive woodland around Red Moss, Corby and Lily Lochs (approximately 35ha inside the scheme footprint) show higher deer activity levels (Table 2).

Table 2 – Evaluation of Roe Deer Activity

Habitat Area	Areas of Deer Habitat	Deer Signs Encountered	Deer Sighting	Deer Activity Level
Section NL1 ch314800 – 316000				
N7	Kepplestone	Yes	Yes	Medium high
N14	Gough Burn Wood	Yes	Yes	Medium-high
N16	Newhill's Wood	Yes	No	Medium
Section NL2 ch.316000 – 317400				
N28	West Lodge Plantation	Yes	Yes	Medium-high
N24	Craibstone (South)	Yes	No	Medium-high
N25	Craibstone Arboretum	Yes	No	Medium-high
N26	Craibstone (North)	Yes	Yes	Medium-high
N21	Parkhead Wood	Yes	Yes	Medium
N22	West Woods	Yes	No	Medium-high
N27	Green Burn Wood	Yes	Yes	Medium-high
N21	Chapelbrae Wood	Yes	No	Medium-low
Section NL3 ch.317400 – 322600				
N34	Farburn Wood	Yes	No	Medium
N35	Standingstones Wood	Yes	Yes	High
N37	Kirkhill Forest	Yes	Yes	High
N43	East Woodlands	Yes	No	Medium
N42	Bogenjoss Burn Wood	Yes	No	Medium
N45	Pitmedden House Wood	Yes	No	Medium-Low
N47	Monument Wood	Yes	No	Medium
Section NL4 ch.322600 – 325370				
N56	Goval Wood	Yes	No	Medium-low
N58	Goval Belt	Yes	Yes	Medium
N64	Upper Tack	Yes	Yes	Low
N65	Skate Wood	Yes	No	Medium-low
N64	Littlejohn's Wood	Yes	No	Medium
N67	Den Wood	Yes	No	Medium-low

Aberdeen Western Peripheral Route
Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

Habitat Area	Areas of Deer Habitat	Deer Signs Encountered	Deer Sighting	Deer Activity Level
Section NL5 ch.325370– 331000 Corsehill – Blackdog				
N71	Corsehill Wood	Yes	No	Medium
N74	Red Moss (West)	Yes	Yes	Medium
N74	Red Moss (East)	Yes	No	Medium
N79	Moss Belt	Yes	No	Low
N85	Lily Loch	Yes	Yes	Medium-high
N93	Leuchlands Croft Plantation	Yes	No	Low
N95	Gourdieburn	No	Yes	Low

5 Risk Assessment

5.1 Introduction

Human Safety and Economic Risk

- 5.1.1 The deer population, including roe deer, is increasing in Scotland (Hunt., 2003). This fact, together with increasing traffic volumes and higher traffic speed, increases the potential RTA risk. The introduction of a high-speed road passing through several areas of high deer activity raises concerns about human safety, economic cost and animal welfare, as well as increasing the risk of accidents.
- 5.1.2 During the operational phase there is a concern over public safety as a consequence of RTA, potentially leading to severe and even fatal injuries to humans.
- 5.1.3 A review of literature published in the United States and Europe has suggested that between 2% and 5% of deer-related accidents would be expected to result in human injury (Langbein, 2004). In Britain each year it is estimated that several hundred injuries occur, including up to 15 human fatalities as a direct consequence of deer related RTAs (Langbein, 2004).
- 5.1.4 Police records of RTAs involving human injury, maintained by Aberdeenshire Council, do not at present enable separation of past incidents involving deer from that of other animals.
- 5.1.5 The Fortis group of insurers, which currently holds 4% of the entire motor insurance market of private cars in the UK, reported a total of 50 claims in Scotland for the year 1999-2000 pertaining to deer related traffic accidents. The average for the 50 claims was £1,380 (Staines et al., 2001). Extrapolation from these data suggests that there are some 1250 deer-related RTAs/annum in Scotland (as a whole) and the insurance costs resulting from such collisions are approximately £1.725 million.

Roe Deer Welfare

- 5.1.6 There is expected to be a low risk to deer during the construction phase, although young fawns may be susceptible to mortality and disturbance in the few days after birth.
- 5.1.7 During the operational phase there is a potential risk of RTAs along the corridor of the entire alignment resulting in deer injury or fatality. A deer welfare issue arises if a deer is injured. Many of the deer involved in RTAs are not killed outright but die later of their injuries (Staines et al., 2001), or may need to be humanely destroyed at the road side by an appropriately qualified person, normally by use of a firearm.

Aberdeen Western Peripheral Route
Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

5.1.8 Although some areas of woodland did not have high levels of roe deer activity during field surveys, roe deer distribution range and population numbers are increasing (Hunt, 2003) and may be expected to continue to increase in future years. Consequently, roe deer numbers could increase near towns or built up areas (and near high speed roads) where deer control tends to be more difficult.

Risk of RTAs

5.1.9 The assessed risk of deer-related RTAs and impacts upon deer habitat supporting medium to high activity levels are presented by Habitat Area for each Section in Table 3. The risk of RTAs is considered to be higher where areas of woodland or scrub would suffer habitat loss and/or habitat fragmentation as a result of the proposed scheme.

5.1.10 Seven areas of woodland are predicted to have a **high** risk magnitude: Craibstone Arboretum (N25), Craibstone (North) (N26) and Green Burn Wood (N27) in Section NL2; Standingstones Wood (N35), Kirkhill Forest (N34, N37 and N38) and Monument Wood (N47) in Section NL3; and Littlejohn's Wood (N72) in Section NL5.

5.1.11 All of these woodland habitats would be subject to habitat loss, severance and fragmentation. The proposed scheme would result in potential for obstructed line of sight in Standingstones Wood, Kirkhill Forest, East Woodland, Corsehill Wood, Littlejohn's Wood and Red Moss West; this is likely to increase the potential RTA risk and consequential human risk in these areas.

Table 3 – Predicted Risk Assessment for Potential RTA Areas (Sections NL1 – NL5)

Habitat Areas	Areas of Deer Habitat	Impact on Woodland/Scrub habitats		Deer Activity (Med to High)	Potential for Obstructed line of Sight	Magnitude of Risk
		Severance and fragmentation	Loss of habitat			
Section NL1 ch314800 – 316000						
N13 and N12	Kepplestone			✓		N13 and N12
N14	Gough Burn Wood			✓		N14
Section NL2 ch316000 – 317400						
N21	Parkhead Wood			✓		N21
N22	West woods			✓		N22
N24	Craibstone (South)			✓		N24
N25	Craibstone Arboretum	✓		✓		N25
N26	Craibstone (North)	✓		✓		N26
N27	Green Burn Wood	✓		✓		N27
Section NL3 ch317400 – 322600						
N35	Standingstones Wood	✓		✓	✓	N35
N34, N37 and N38	Kirkhill Forest	✓		✓	✓	N34, N37 and N38
N43	East Woodlands		✓	✓	✓	N43
N47	Monument Wood	✓		✓		N47
Section NL4 ch322600 – 325370						
N71	Corsehill Wood			✓	✓	N71

Aberdeen Western Peripheral Route
 Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

Habitat Areas	Areas of Deer Habitat	Impact on Woodland/Scrub habitats		Deer Activity (Med to High)	Potential for Obstructed line of Sight	Magnitude of Risk
		Severance and fragmentation	Loss of habitat			
Section NL5 ch325370– 331000						
N72	Littlejohn's Wood	✓		✓	✓	N72
N74	Red Moss West			✓	✓	N74
N85	Lily Loch			✓		N85

6 Mitigation

6.1 Generic Mitigation

6.1.1 The generic mitigation recommendations proposed below are those designed to minimise the risk of RTAs on various protected mammals along the proposed scheme, but which will also serve to mitigate for impacts on deer. It is important to emphasise that the proposed measures are required to mitigate impacts on protected species, and not for deer conservation. The locations of fencing and overpasses along the proposed scheme have been designed to correspond with mitigation for other species, specifically badger and otter, as detailed in separate reports (see Appendices A10.2 and A10.6). The generic mitigation measures recommended for use along the proposed scheme include:

- roadside fencing for otters and badgers;
- vegetation clearance or management of road side strips, embankments and cuttings in areas where there is no planting for landscape or ecological purposes; and
- green bridges or wildlife overbridges for protected species.

Roadside Fencing

6.1.2 A timber post and 4-rail 1.4m high stockproof fence will be installed along the highway boundary for the full length of the scheme, upgraded where necessary to meet badger-proof and otter-proof requirements. To channel animals towards established safe crossing points, fencing breaks are only proposed where it connects with a mammal crossing, green bridge, overbridge or underpass. The badger/otter fencing must be located 2m up slope from the base of an embankment where possible, to increase its effectiveness.

6.1.3 It is important to note that this strategy is designed to channel animals towards a safe crossing point rather than preventing road-crossings altogether. This also alleviates pressure on the fence itself from animals trying to breach it, if there are no other means of crossing the carriageway. Deer that are intent on crossing are likely to continue to attempt and eventually to succeed at breaching the fence, unless some easier (and safer) alternative means of passage to habitat on the opposite side of the carriageway is available. Putman et al. (2004) also note that continuous deer fencing, if breached by deer, has a potential to increase the likelihood of RTAs as animals may become trapped on the road.

6.1.4 Deer tend to follow fence lines in order to find the easiest way through or around such barriers, and the proposed fencing is therefore anticipated to fulfil a secondary function of reducing potential for deer RTAs. Fences should be positioned in relation to the topography of the land in order to prevent deer from jumping the fencing and therefore:

- not be positioned directly below the slope of a cutting;
- not traverse a slope of a cutting; or

Aberdeen Western Peripheral Route
Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

- be erected close to any undulating land.

6.1.5 Fencing has been shown to reduce accident frequency in relation to migrating mule deer in Wyoming (Ward, 1982) in (Staines et al., 2001).

Maintenance of Fencing

6.1.6 There is the potential for fencing to fail or become breached by deer that try to cross the road. To reduce the possibility of future RTAs, the fence will be checked regularly for damage and repaired as soon as possible. The fence must also be maintained at regular intervals and to a high standard.

Green Bridges or Wildlife Overbridges

6.1.7 Safe alternative crossing points may be provided by green bridges or wildlife overbridges. In all cases where crossing points are provided, roadside fencing will be designed to direct protected species towards these points. Habitats on both sides of proposed carriageway can be linked by planting.

6.1.8 The Kirkhill Wildlife overbridge proposed at ch319960 will be 7.5m width, with splayed wing walls to 'funnel' species over the bridge. The wildlife overbridge will be vegetated across the full width, including scrub woodland.

6.1.9 The Green Bridge proposed at ch320180 (Kirkhill Overbridge) will provide a 4.5m carriageway for land access, a 1m access pathway, and a 4.5m vegetated strip for wildlife use.

Vegetation Management of Road Side Strips

6.1.10 Studies in countries other than the British Isles (Waring et al., 1991 cited in Staines et al., 2001) have shown that high vegetation immediately adjacent to the carriageway potentially increases the risk of a deer related accident in specific areas by attracting deer closer to the road and impeding the motorists' line of sight. They have also shown that removal of vegetation reduces the level of that risk. However, it is not suggested that large-scale removal and suppression of vegetation is an effective mitigation measure (Staines et al., 2001; Putnam et al., 2004).

6.1.11 Any management of vegetation that does take place should ideally be conducted during the autumn season, as re-growth may attract deer close to the carriageway (Rea, 2003 cited in Putnam et al., 2004).

Deer Management and Monitoring

6.1.12 Given that the main concerns are not related to conservation, but deer welfare and human safety, a monitoring scheme must be adopted to ensure that reductions in future RTAs are maintained. If RTAs are frequently observed in a particular area then further mitigation measures must be implemented or improvement to existing measures must be addressed.

6.1.13 The monitoring scheme must run for at least the first five years of operation although RTAs that occur beyond this time must be logged by the Highways Maintenance agents responsible for clearing animal carcasses from the new road, and reported to the Deer Collisions Project (www.deercollisions.co.uk) whilst it remains on-going.

6.1.14 Monitoring the success of the mitigation measures must be implemented to ensure that a reduction in deer collision risk is maintained for the foreseeable future. As well as ensuring a cost-effective deer management strategy for the proposed scheme, this will provide important information for future road schemes in Scotland. Results from monitoring will provide informed judgement to predicting areas that become ineffective or areas that are susceptible to breaching by deer. This

will assist in targeting specific fencing requirements accurately and effectively promoting efficient use of resources.

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Aberdeen Western Peripheral Route
Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

Annex 1

Deer Collision Records Supplied by Grampian Police Control and Aberdeenshire Council Roads Department for 2003 – 2004 (National Deer Collisions Project)

Date	Time reported/collected	Road No.	Location	OSREF	GRIDACC	Species of Deer	Gender	Habitat Wooded/Open	Was The Road Deer Fenced?	Source
22/11/2004	14:00	B9077	Ardoe Hall South Deeside Road	NJ901020	2km	Roe	M	Open	No	South Aberdeenshire Council
04/11/2004	13:35	B977	Parkhill Road	NJ908144	2km	Roe	F	Wooded	No	Central Aberdeenshire Council
02/11/2004	11:30	Unclass	Banchory/Devenick Area	NJ909015	2km	Roe	F	Open	No	South Aberdeenshire Council
11/10/2004	09:35	B977	Parkhill to Dyce	NJ902147	2km	Roe	F	Wooded	No	Central Aberdeenshire Council
09/09/2004	10:25	B9077	Maidenfold Ardoe	NJ899020	2km	Roe	M	Wooded	No	South Aberdeenshire Council
21/07/2004	14:15	B999	Potterton	NJ939154	2km	Roe	F	Open	No	Central Aberdeenshire Council
06/07/2004	13:34	A96	A96 roundabout - Airport	NJ879106						Grampian Police control
28/06/2004	13:00	B9077	Ardoe House, Banchory Devenick	NJ901021	2km	Roe	M	Wooded	No	South Aberdeenshire Council
22/06/2004	16:50		Kingswells - Bucksburn	NJ866084	2km					Grampian Police control
11/06/2004	14:00	B977	Parkhill	NJ909153	2km	Roe	F	Open	No	Central Aberdeenshire Council
11/06/2004	14:45	B999	Potterton	NJ939149	2km	Roe	M	Open	No	Central Aberdeenshire Council
08/06/2004	09:30	A90	At the Aberdeen Boundary	NO931999	2km	Roe	M	Open	No	South Aberdeenshire Council
28/05/2004	23:09		Drum Castle	NJ 803004	2km					Grampian Police control
25/05/2004	07:30	B9077	Ardoe South Deeside road	NJ902021	2km	Roe	F	Wooded	No	South Aberdeenshire Council
11/05/2004	14:00	B977	Parkhill	NJ908151	2km	Roe	F	Open	No	Central Aberdeenshire Council
11/05/2004	14:45	B999	Potterton	NJ939152	2km	Roe	M	Open	No	Central Aberdeenshire Council
14/04/2004	10:00	B9077	Blairs Colledge South Deeside Rd	NJ884012	1km	Roe	F	Wooded	No	South Aberdeenshire Council
30/03/2004	00:12	B999	B999 Newmachar turn off	NJ917189	1km					Grampian Police control
26/02/2004	11:30	B9077	Blairs	NJ883012	1km	Roe	F	Wooded	No	South Aberdeenshire Council
09/02/2004	20:31		Drum Castle Drumoak	NJ803004	3km					Grampian Police control
08/02/2004	00:30		Mugiemoss Road Bucksburn	NJ887093	2km					Grampian Police control

Aberdeen Western Peripheral Route
Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

Date	Time reported/collected	Road No.	Location	OSREF	GRIDACC	Species of Deer	Gender	Habitat Wooded/Open	Was The Road Deer Fenced?	Source
13/01/2004	14:02		Whitestripes Road, Aberdeen	NJ908041	1km					Grampian Police control
30/12/2003	18:24		Skene Road Aberdeen	NJ890061						Grampian Police control
27/12/2003	11:30	B9077	Tilbourie Blairs	NJ863003	4km	Roe	F	Open	No	South Aberdeenshire Council
23/12/2003	10:00	B9077	Half mile east of Blairs	NJ893015	1km	Roe	F	Wooded	No	South Aberdeenshire Council
10/12/2003	14:30	B9077	Half mile west of Maryculter house	NO841988		Roe	F	Wooded	No	South Aberdeenshire Council
28/11/2003	16:00	B9077	Half mile West of Blairs College	NJ885014		Roe	F	Wooded	No	South Aberdeenshire Council
27/11/2003	11:00	Unclass	Dykeneuk Blairs	NJ884007		Roe	F	Open	No	South Aberdeenshire Council
20/11/2003	08:30	A93	Coalford Drumoak	NJ808002		Roe	F	Wooded	No	South Aberdeenshire Council
12/11/2003	11:00	B9077	Ardoe House South Deeside Rd	NJ898017		Roe	M	Wooded	No	South Aberdeenshire Council
11/11/2003	11:00	B979	Burnside Netherley	NO850972		Roe	F	Open	No	South Aberdeenshire Council
07/11/2003	11:15	Unclass	Banchory/Devenick to Maryculter	NO900998	10	Roe	M	Wooded	No	South Aberdeenshire Council
04/11/2003	15:00	B9077	Craiglug Durriss	NO815979		Roe	F	Wooded	No	South Aberdeenshire Council
31/10/2003	11:00		Hillhead, Kintore	NJ799164	10	Roe	M	Wooded	No	Central Aberdeenshire Council
30/10/2003	08:00	B9077	Ardoe old police station	NJ892016		Roe	M	Wooded	No	South Aberdeenshire Council
25/10/2003	00:21		Wellheads Drive Dyce	NJ883110	2km					Grampian Police control
19/10/2003	05:04		Bucksburn - Kingswells	NJ867086	2km					Grampian Police control
14/10/2003	10:00	B9077	Ardoe old police station	NJ892016		Roe	F	Wooded	No	South Aberdeenshire Council
19/09/2003	07:30	A93	Newmill Peterculter	NJ826012		Roe	F	open	No	South Aberdeenshire Council
19/09/2003	07:32	A93	Newmill Peterculter	NJ826012		Roe	F	Open	No	South Aberdeenshire Council
17/09/2003	02:38		Balgownie Drive Bridge of Don	NJ931097						Grampian Police control
17/09/2003	a.m.	B997	Parkhill Cross Roads to Aberdeen	NJ889145		Roe	M	Wooded	No	Central Aberdeenshire Council
16/09/2003	a.m.	B979	Blackburn to Wogel Road	NJ825120	10	Roe	M	Wooded	No	Central Aberdeenshire Council
05/09/2003	00:39		Eigie Road Balmedie	NJ968177	1km					Grampian Police control
01/09/2003	11:15	B9077	One mile east of Durriss Bridge	NO807978		Roe	F	Wooded	No	South Aberdeenshire Council

Aberdeen Western Peripheral Route
Environmental Statement Appendices 2007
Part B: Northern Leg
Appendix A10.11 - Deer

Date	Time reported/collected	Road No.	Location	OSREF	GRIDACC	Species of Deer	Gender	Habitat Wooded/Open	Was The Road Deer Fenced?	Source
26/08/2003	p.m.		Blackburn to Westhill Road	NJ825126	10	Roe	F	Wooded	No	Central Aberdeenshire Council
21/08/2003	07:30	B9077	Half mile from Blairs Colledge	NJ885114		Roe	M	Open	No	South Aberdeenshire Council
19/08/2003	13:30	A90	Cammachmore Southbound	NO909949		Roe	M	Open	No	South Aberdeenshire Council
05/08/2003	a.m.	B977	Parkhill	NJ900149	10	Roe	M	Wooded	No	Central Aberdeenshire Council
31/07/2003	10:00	B977	Parkhill	NJ900149	10	Roe	F	Wooded	No	Central Aberdeenshire Council
19/06/2003	11:00	B9077	Park Quarry	NO807978		Roe	M	Wooded	No	South Aberdeenshire Council
18/06/2003	06:59		Old Skene Road Kingswells	NJ81500715	3km					Grampian Police control
18/06/2003	a.m.	B993	Kinmuck - Fintry Road	NJ8319	10	Roe	M	Open	No	Central Aberdeenshire Council
27/05/2003		B977	Balbithier to Fintry No.1	NJ805162	1			Wooded		Central Aberdeenshire Council
27/05/2003		B977	Balbithier to Fintry No.2	NJ805162	1			Wooded		Central Aberdeenshire Council
23/05/2003		B977	Broomhill Kintore	NJ817165	10			Wooded		Central Aberdeenshire Council
20/05/2003		A90	Balmdie	NJ965185	1			Grass		Central Aberdeenshire Council
14/04/2003		B900	Dyce to Potterton Road	NJ920160	10			Wooded		Central Aberdeenshire Council
11/04/2003	22:00		Parkhill - Aberdeen	NJ908145	2km					Grampian Police control
19/03/2003		B9077	Millbank	NJ863003				Wooded		Central Aberdeenshire Council
01/02/2003	22:15		Countesswells Road	NJ888043	1km					Grampian Police control
	Jan 03	A93	Drum Castle	NJ805000		Roe		Wooded		South Aberdeenshire Council
	May 03		Ardoe House, South Deeside Road	NJ898017		Roe		Wooded		South Aberdeenshire Council
	May 03	B9077	Denside, Durris, South Deeside Rd	NO804974		Roe		Wooded		South Aberdeenshire Council
	Apr 03	B9077	Park Junction, South Deeside Rd	NO804975		Roe		Wooded		South Aberdeenshire Council
	May 03	B979	Parkhead, Maryculter	NO853994		Roe		Wooded		South Aberdeenshire Council
	Feb 03		Blairs- Auchenblae Road, Maryculter	NO877986		Roe		Wooded		South Aberdeenshire Council
	Apr 03	A90	Bowtree Junction Northbound	NO909958		Roe		Grassed		South Aberdeenshire Council