
**VOLUME 10 ENVIRONMENTAL
DESIGN AND
MANAGEMENT
SECTION 4 NATURE CONSERVATION**

PART 1

HA 84/01

**NATURE CONSERVATION AND
BIODIVERSITY**

SUMMARY

This Advice Note provides guidance on the principles of how nature conservation and biodiversity issues should be treated in the design, construction and management of Highways.

INSTRUCTIONS FOR USE

1. Remove HA 59/92 (Nature Conservation only) from Volume 10, Section 1, which is superseded by HA 84/01 and archive as appropriate. (HA 59/92 Amendment No 1 is extant.)
2. Insert HA 84/01 into Volume 10, Section 4.
3. Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.



THE HIGHWAYS AGENCY



**THE SCOTTISH EXECUTIVE DEVELOPMENT
DEPARTMENT**



**THE NATIONAL ASSEMBLY FOR WALES
CYNULLIAD CENEDLAETHOL CYMRU**



THE DEPARTMENT FOR REGIONAL DEVELOPMENT*

Nature Conservation and Biodiversity

* A Government Department in Northern Ireland

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REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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**VOLUME 10 ENVIRONMENTAL
DESIGN AND
MANAGEMENT**
**SECTION 4 THE GOOD ROADS
GUIDE - NATURE
CONSERVATION**

PART 1

HA 84/01

**NATURE CONSERVATION AND
BIODIVERSITY**

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1.1 SCOPE

This advice note gives guidance on the principles of how nature conservation and biodiversity issues should be treated within the design and construction of road infrastructure projects, and their post-completion management.

It is intended for use by designers within Overseeing Organisations and their consultants, and managing agents (including their equivalent in Wales, Scotland and Northern Ireland) and their contractors.

Users of this advice should be aware of the context in which the Overseeing Organisations are working. This context is usually described in policy guidance, Management Strategies, Environmental Action Plans and Biodiversity Action Plans where available. The guidance below should be used to assist in meeting the commitments and targets in those documents where appropriate.

In certain circumstances the advice in this Note will need to be considered in the light of other non-nature conservation priorities (eg landscape integration, road safety, pollution control etc). The decision to follow the advice in this Note should be based on seeking a balance, where possible, between the relative importance of the various priorities involved.

- In this Note reference to Nature Conservation also includes Biodiversity.
- Issues relating to Environmental Assessment techniques are covered in DMRB Volume 11 Section 3 Part 4.
- Specific guidance for some species is provided in advice notes within this Section of DMRB Volume 10. Specific advice in relation to other issues can be found in the references provided in the Bibliography.



Wildflowers on embankment. M25/M40

1.2 KEY ISSUES

- Natural processes which affect species and habitats are dynamic and interrelated. All nature conservation proposals should reflect this.
- Road infrastructure projects wherever possible should maintain and protect surrounding habitats, including the systems on which they depend eg hydrology, soils, geology.
- It is essential where nature conservation work is required, appropriately qualified professionals are used; and advice from suitably experienced specialists, statutory consultees and other conservation bodies is obtained.
- Projects must take into account local, regional, national or international wildlife sites and protected/ rare species and habitats. Habitats, species and sites covered by UK and European legislation need to be considered in the light of the relevant legislation and policy guidance so as to avoid the implications of non-compliance.
- Nature conservation issues must be incorporated from the earliest stages of project development as part of the decision making process.
- Negative impacts (eg habitat loss, territory severance, pollution), should be avoided wherever possible. If this is not possible the impacts should be mitigated for. Only as a last resort should techniques such as translocation/relocation be considered.
- Road infrastructure projects need to consider both the area to be affected and the surroundings to an appropriate scale for the species and habitats involved.
- Where specific nature conservation measures are to be applied, appropriate aims and objectives should be agreed before design starts, if necessary, with the overseeing organisation and statutory consultees.
- When developing project timetables, it is essential that the most appropriate time of the year is identified for undertaking surveys and carrying out the works.
- Designs for nature conservation measures should ensure that they are able to maintain their purpose through appropriate ongoing management.
- Opportunities for habitat creation and enhancement should be taken wherever possible.
- Projects must include consideration of the need for post-construction management within the design process.
- Records should be kept of the design, application and management of specific nature conservation measures for future reference.
- An Environmental Site Co-ordinator/Clerk of Works should be appointed to oversee the design and implementation of nature conservation works where appropriate.

1.3 EFFECTS OF ROADS ON NATURE CONSERVATION

Road infrastructure projects can have a range of effects on nature conservation. The following effects are known to occur, but may not be relevant in all situations.

- Habitat loss - direct loss, permanently or temporarily, of valuable habitats.
- Habitat fragmentation - habitats can be divided resulting in loss of species diversity due to isolation and loss of available resources.
- Barriers to species movement - movement patterns can be changed or impeded resulting in negative effects (eg reproductive isolation, road casualties).
- Physical alterations to roads - can create opportunities for improving/enhancing existing habitats (eg re-establishing connectivity or introducing new habitats in relatively poor areas).
- Pollution of air resources – pollutants (eg dust, exhaust gases) can contribute to reduced air quality and climate change, potentially affecting plants and animals.
- Pollution of water resources – pollutants (eg spillages, untreated road runoff) can contribute to reduced water quality, potentially affecting aquatic plants and animals.
- Pollution of land resources – appropriate management can reduce the negative effects (eg effects on species and habitats of litter and unwanted herbicide spray drift).
- Noise - disturbance from noise has been shown to affect breeding and feeding in some bird species. Effects on other species are currently under investigation.
- Artificial lighting - current research has shown both positive and negative effects dependent on the species and type of lighting involved.
- Introduced materials - can cause the spread of invasive species and inappropriate conditions for plant growth.
- Changes in drainage regimes - can change the influence of water available to plants, affecting existing and newly planted habitats.
- Human/vehicular presence - can cause visual disturbance to some species (eg wading birds and waterfowl).



Deer Warning Sign – Bryansford near Newcastle, Northern Ireland

1.4 RELEVANT LEGISLATION AND POLICY

Nature conservation in the UK is based on an extensive framework of international, European and national legislation and policy guidance (see Annex 2).

Overseeing Organisations and their consultants/contractors need to ensure that they are fully aware of the relevant legislation and policy guidance, which is applicable to their situation.

Responsibility for legislation and high-level policy guidance lies with the DETR and their corresponding Governmental departments, in Wales (National Assembly for Wales), Scotland (Scottish Executive) and Northern Ireland (Department of the Environment).

Users of this Note should be aware that nature conservation measures can provide an important contribution to sustainable development and biodiversity goals and targets. Projects should be guided by the principles of these two policies as described in the relevant Government and Overseeing Organisations' documents (see Chapter 5 Bibliography).

Biodiversity Action Plans should be used to inform nature conservation actions to conserve and where possible, enhance biodiversity. Action Plans are prepared by a wide range of organisations including National and Local Government.

Users of this advice should consult with the relevant Overseeing Organisation where necessary to ensure that the application of this advice is in accordance with legislation and policy guidance.

1.5 STATUTORY CONSULTEES

Within this Part references to Statutory Consultees means the following organisations:

England

- English Nature (EN)
- Environment Agency (EA)

Northern Ireland

- Environment and Heritage Service (EHS)

Scotland

- Scottish Natural Heritage (SNH)
- Scottish Environmental Protection Agency (SEPA)

Wales

- Countryside Council for Wales (CCW)
- Environment Agency Wales (EA Wales)

1.6 OTHER CONSULTEES/ORGANISATIONS

The following may need to be consulted in relation to their interests, and to obtain relevant information:

- Local Authorities
- Non-Governmental Organisations - National Trust, RSPB, The Wildlife Trusts etc.

Other Nature Conservation Organisations may have appropriate detailed information which may be relevant for projects (eg Biological Records Centres, British Trust for Ornithology, Mammal Society, Fauna & Flora International, Joint Nature Conservation Council, The National Biodiversity Network, Butterfly Conservation etc)

1.7 OTHER CONSIDERATIONS RELEVANT TO PROJECT DEVELOPMENT

Listed below are considerations, which although not limited to nature conservation projects must be incorporated (those relating to survey, mitigation and other techniques are included later in this Advice Note).

- Land Acquisition – provision must be made to enable the purchase of land for the nature conservation measures either by Statutory Powers or agreement (eg Section 253 of Highways Act 1980).
- Access – provision must be made to obtain the necessary legal powers to access land as and when required.
- Financial Planning – costs should be identified and budgeted for in sufficient time (ie as early in the design process as possible). Costs can involve the application of special mitigation measures, their ongoing maintenance for the whole time period over which the measures are expected to work, and post-construction monitoring where appropriate.



M90, Kinross, Scotland

2.1 SPECIES

Some plant and animal species are given special protection by UK and European legislation (see Annex 2).

Advice Notes within this Section of Volume 10 contain more detailed advice notes for some animal species.

Annex 3 of this note lists some other animal species that are likely to be encountered in road projects and provides initial advice. Where species not covered by advice in Volume 10 are involved, specialist advice should be obtained where appropriate.

- Projects should avoid the habitat of protected or rare species, and direct or indirect negative affects on populations and movements of those species. Where this is not possible, appropriate mitigation must be provided. Translocation/relocation should be undertaken as a last resort.
- Some species may need very specific types of habitat for survival, while others may require a range of habitats. Projects to enhance, create or translocate/relocate species must take into account natural conditions (eg hydrology, climate, topography, appropriate soil types etc) and as far as is known, the whole life cycle requirements of the species.
- The relevant legislation must guide actions and decisions when protected species are affected.
- Statutory Consultees must be approached for advice when legally protected species are affected. Some species require specific licences from Statutory Consultees before any work affecting them can be carried out.
- The protection of species often extends to their habitats.
- Work (eg surveys and design of specific measures) should be undertaken by specialists in that species and carried out at the appropriate stages of project development (eg survey at project investigation stages).



Deer Underpass

2.2 HABITATS

Some habitats are given special protection by UK and European legislation (see Annex 2).

Annex 4 of this note lists some habitats that are likely to be encountered in road schemes and provides some initial advice. Where habitats not covered by this advice are involved, specialist advice should be obtained where appropriate.

- Projects should avoid protected or rare habitats thus preventing direct or indirect negative effects on those habitats. Where this is not possible, appropriate mitigation, and as a last resort translocation/relocation, should be undertaken.
- Relevant legislation must be referred to when protected habitats are affected.
- Statutory Consultees must be approached for advice when legally protected or rare habitats are affected.
- Projects can provide opportunities for enhancing and creating habitats, and encouraging a natural succession where appropriate.

- Some habitats require very specific conditions to survive. Projects to enhance, create or translocate/relocate habitats must take into account natural conditions (eg hydrology, climate, topography, appropriate soil types etc).

It can be difficult for new habitats to replace natural habitats which have developed over time. Some habitats are relatively easy to reproduce (like scrub), while others (such as fens and mature woodland) are much more difficult or impossible to recreate within the boundaries of current knowledge.



Ancient woodland site: A494 Mold Bypass, Wales

2.3 DESIGNATED SITES

Sites with habitats and/or species of high nature conservation importance can be designated under national, UK and European legislation, or International Convention. The level of protection is defined in the relevant legislation or Convention (see Annex 2).

International designations currently include Biosphere Reserves, Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Ramsar Sites.

UK designations currently include Sites of Special Scientific Interest (SSSI), Areas of Special Scientific Interest (ASSI), National Nature Reserves (NNR), and Marine Nature Reserves (MNR).

Local Authorities can delineate areas of local or regional importance such as Sites of Nature Conservation Interest (or an equivalent title), and designate Local Nature Reserves. Throughout this advice, reference to designated sites applies equally to delineated sites.

- Projects should avoid creating negative effects on designated sites wherever possible. There is a strong presumption against damaging sensitive sites such as SSSIs.
- Where it is impossible to avoid negative effects, appropriate mitigation (or for international sites if appropriate, compensatory measures) should be provided depending on the status and nature of the site involved.
- If a road project is likely to affect a designated site, either directly or because of the site's proximity to the project, information should be obtained as to the level of designation involved (eg international, national or local) and the nature conservation interest for which the site has been designated. This information should be obtained from the relevant Statutory Consultee or Local Authority.
- If a designated site is directly affected, consultation must be carried out with the appropriate Statutory Consultee or Local Authority. Guidance on the procedures to be followed is contained within the Nature Conservation Policy Guidance notes issued by the relevant national Government departments.



RSPB Reserve, A55 Conwy, Wales

3.1 SCOPE

This Chapter seeks to provide best practice guidance relating to nature conservation works. Users should be aware that best practice may not be appropriate in all cases.

The following principles should be used.

- A sensitive site-by-site approach needs to be applied, with methods used which are relevant to the characteristics of the species and habitats affected, and appropriate to the stage of project development involved.
- Appropriate specialist advice should be obtained in all circumstances. This is essential when protected or rare species or habitats are involved.
- Before undertaking the work, aims, objectives and any constraints should be agreed and made clear to all those involved in the work.
- A range of methods may be appropriate to a particular situation.
- When undertaking work for Environmental Assessment the guidance included in DMRB Vol. 11, Section 3, Part 4 should be followed.

3.2 SURVEYS

Surveys can be carried out at various stages of project development and application: eg initial data gathering; detailed design; prior to construction works; post construction assessment monitoring; and to inform management strategies.

The techniques involved can include: desk top studies of constraints; (designated sites; protected species and habitats) and known significant features; preliminary walkover surveys; detailed specialist field surveys; and, where appropriate, individual species or habitat studies.

Surveys should be guided by the following principles.

- Surveys must take into account an appropriate range of habitats and species which are likely to be affected by the project, including those protected by legislation and covered by biodiversity action plans.
- Surveys must be carried out at an appropriate time of the year, (planned in advance within the overall programme of project procurement and development); and over sufficient period of time to allow appropriate results to be collected. The main seasonal constraints on animal species are given in Annex 1.
- Appropriately experienced surveyors must be used, and recognised survey techniques applied where available.

- Surveys must cover a corridor wider than the working space required. The precise survey width is dependent on the habitat and species present along the route and on the scale and extent of the project involved.
- Surveys should provide the maximum amount of information suitable to meet the aims and objectives for which it is being carried out. Existing data sources should be consulted if available.
- Results should be clearly reported and if appropriate recommendations to guide the project development should be provided in relation to those habitats and species surveyed.

3.3 MITIGATION FOR NEGATIVE EFFECTS

The known negative effects of road infrastructure have been listed earlier in this Advice Note (Chapter 1, Section 1.3). Knowledge of these effects and their implications for wildlife in some cases is limited, and not all of these effects may be relevant in all situations.

Avoiding the negative effects of the project should be the first intention of any project. Mitigation should be provided where this is not possible. Mitigation design should be provided on a site-by-site basis, taking account of appropriate survey information. The design should minimise, if not remove, the effects present in that situation. The aims and objectives of the mitigation and any post-construction monitoring should be agreed before the mitigation design process starts.

The guidance below seeks to provide best practice as far as is currently known, but specialist advice should be obtained to provide further detail.

For issues relating to the nature conservation effects of noise, light, air and water pollution, advice should be obtained as to the sensitivity of the receptors and the likely effectiveness of any mitigation measures from specialists in those fields (and if necessary the relevant Statutory Consultee).

- Land taken or disturbed by project works should be minimised, except where there is a need to acquire more extensive areas of land for environmental mitigation.
- Where practicable, and within the powers and resources of the Overseeing Organisation, opportunities for habitat creation or enhancement and species protection should be taken in addition to providing mitigation.
- Timing of activities should avoid impacts on protected and rare species and habitats wherever possible. Annex 1 gives seasonal information relating to a number of animal species.
- Mitigation design should retain, or wherever possible create, natural habitat links which may act to assist wildlife movements. Special engineering features (eg tunnels, ledges, and bridges) combined with fencing where appropriate, can be used to assist in maintaining links across roads. Some species specific advice is provided in other Advice Notes in this Section of Volume 10.

- To minimise the negative effects of construction (eg contamination of the surrounding environment), management and control of work areas is essential. Consideration should be given to the provision of buffer strips, protective fencing and restricted access around work areas.
- Road lighting should be designed to minimise light spillage near sensitive wildlife sites.
- Measures to control and treat road runoff should be installed where needed to protect valuable wildlife sites. In sensitive cases, consideration should be given to preventing discharge of highway runoff to the site, and to creating separate water features for nature conservation if suitable land is available.
- Measures to reduce the effects of visual and noise pollution should be applied next to sensitive wildlife sites where appropriate.

3.4 HABITAT CREATION AND ENHANCEMENT

Road projects can provide opportunities for habitat creation and enhancement, which in turn may provide suitable conditions for species and habitats of nature conservation value. Creation and enhancement can be undertaken alongside other works, such as mitigation and translocation, and ongoing roadside management.

Designs for the project should be based on appropriate survey information and on an understanding of the natural processes and human influences relating to that site. Consideration must be given as to whether specific conditions need to be created (eg combinations of plants and microclimates, low fertility/nutrient levels in soils and seasonal water levels).

The aims and objectives of the project and any post-application monitoring should be agreed before the design process starts.

The guidance here seeks to provide best practice as far as is currently known, but specialist advice should be obtained. Further information relating to individual habitats is included in Annex 4.

- Projects should be sustainable and appropriate resources made available for ongoing management.
- Creation and enhancement should not be carried out on sites which already have a nature conservation value, or in situations where the resultant impacts on wildlife from road use may become significant.
- Linkages (eg continuous or 'stepping stones') between habitats, using existing routes if available, should be restored or created where practicable. Installations such as tunnels, ledges, culverts or bridges, in association with fencing, should be used to achieve this.
- Opportunities for additional or alternative areas of habitats should be used to reduce the effects of fragmentation where land is suitable.

- Opportunities for natural habitat/species migration, or species introduction should be encouraged where possible. Techniques such as soil stripping where a suitable seed source is nearby, and installation of artificial nesting and roosting sites could be used.
- Materials used for projects should be from an appropriate source to support the relevant habitats and species. Any soil used should be appropriate to the location and habitat, handled so that the characteristics of the soil are maintained, and checked to eliminate any unwanted invasive plant material.
- Plant material, including seeds, should be from an appropriate UK provenance, depending on the availability of the species and the sensitivity of the site. Regional and local provenance stock should be used where appropriate (eg on sensitive wildlife sites).
- Provision should be made to obtain the necessary resources and permissions (eg licences and access) in time for the works to be carried out.



Habitat Creation at Bathampton Meadows : A4/A46 Batheaston to Swainswick

3.5 TRANSLOCATION

Translocation or relocation should only be undertaken as a last resort after avoidance and mitigation of effects has been fully considered, and only where nature conservation benefits can be achieved.

Translocation of some protected rare animals, plants and habitats (eg fens and mature woodland) can be difficult to undertake. Long term success is dependant upon the number and complexity of environmental factors involved and the limits of current scientific knowledge.

Translocation inevitably alters the stability and composition of both donor and recipient habitats, and can cause stress to species that are moved. Any proposal should seek to minimise this as far as possible.

The following guidance must be applied when considering or undertaking translocation:

- Appropriate assessments must be carried out of both donor and recipient sites, (including hydrological, climatic and ecological conditions) to inform the decision on whether translocation is an option. Translocations are most likely to be successful when conditions at the donor and recipient sites are closely compatible.
- A detailed specification and timetable for the work must be prepared using specialist ecological advice. This will include ongoing appropriate management and monitoring.
- Where designated sites, protected or rare species or habitats are affected (at either the donor or recipient sites), consultation must be carried out with the appropriate Statutory Consultee throughout the project design, development and construction phases.
- Provision must be made to obtain the necessary resources and permissions (eg licences and access) in time for the works to be carried out and to enable appropriate ongoing management and monitoring to be undertaken.
- An appropriately experienced Environmental Site Co-ordinator/Clerk of Works should be appointed to supervise any works undertaken.

3.6 CONSTRUCTION AND POST-CONSTRUCTION MONITORING

Monitoring should be considered for all nature conservation projects, especially where protected species or habitats are involved, or where the knowledge obtained could inform good practice in the future.

Consideration must be given to the following principles when designing and implementing the monitoring programme:

- Advice should be obtained from Statutory Consultees when protected species or habitats are involved.
- The design and application of monitoring programmes should be undertaken using appropriately experienced specialists, with the aims and objectives agreed before the design process is started.
- The design must be based as far as possible on established monitoring methodologies. Standard survey techniques, depending on the objectives of the monitoring, may not be appropriate for monitoring purposes.
- Monitoring should be undertaken over a time period which is practicable to achieve, and that will provide appropriate results to assess the success or otherwise of the measures. This period will be affected by the time needed for the habitat or species to achieve an appropriate level of stability (eg certain wetland habitats 2-3 years; some grasslands 5-10 years etc).

4.1 SCOPE

This Chapter provides an overview of the best practice in nature conservation to be applied as a project progresses over time, however not all the recommendations listed here may be appropriate to every situation.

4.2 PREPARATION

The considerations listed below cover the period from initial project identification to the start of construction. Guidance in relation to projects requiring Environmental Assessment can be found in DMRB Volume 11.

- Appropriate specialists should be appointed to undertake and oversee the necessary works.
- An experienced Environmental Site Co-ordinator/Clerk of Works may be used where multiple environmental considerations are involved to co-ordinate the works at the design stage.
- Sufficient time and financial resources must be identified to undertake the work.
- The physical extent of the proposed infrastructure and its effects should be identified and agreed with the Overseeing Organisations.
- An appropriate study area should be identified to guide any information collection or survey. The area should reflect the nature conservation interest involved, and the scale of works and their possible effects.
- The scope of the data collection or survey and methodologies to be employed, should be identified, and if necessary agreed with the Overseeing Organisations. The period of the survey should be appropriate to the species/habitat involved.
- All relevant species, habitats and designated sites in the study area must be identified and reported. Information should be updated where there has been significant change either to the project or the affected nature conservation interest.
- The potential effects of the project and their significance must be considered in relation to the scale of the project, and the importance of the species, habitats and sites involved (eg the national context of the species and habitat).
- Design of the project (including any post construction monitoring and management) must be developed at an appropriate level of detail for the nature and extent of the works.
- Consultation with Statutory Consultees, affected landowners and interested parties should be carried out if necessary (eg Statutory Consultees for protected species, and landowners whose land is to be taken), when sufficient project detail is available.
- Appropriate approvals and resources to take the project forward, in sufficient time should be obtained.

4.3 CONSTRUCTION

The considerations listed here cover the period from tender invitation to completion of construction and any associated defect liabilities.

- Tender invitation documents should provide sufficient specification to ensure that the appropriate skills and techniques are used during construction to achieve the necessary results in the long term. Wherever possible specifications should be based on existing experience of that particular type of work. Specialist advice on specification should be obtained.
- Appropriate species licences must be obtained in advance of any works.
- An Environmental Site Co-ordinator/Clerk of Works should be appointed to oversee the application of the works, to co-ordinate with other participants in the project and to ensure site staff are aware of the issues involved. An appropriate job description with clear responsibilities and reporting lines should be drawn up.
- Any advanced works required should be planned and carried out in line with specialist advice, and in sufficient time before work starts. The works must comply with any relevant legal requirements and seek to avoid, or otherwise minimise negative effects.
- Where clearance of an area or a feature containing protected or rare species (eg birds during breeding periods, bats, reptiles etc) is to take place, pre-works surveys must be undertaken to ensure that no protected species are present when work starts. Where protected species are found during clearance, work should be halted and appropriate advice obtained as to how to proceed.
- Measures such as fencing and traps to exclude species from the site must be in place before work starts, and must be inspected at regular intervals in line with best practice. Where measures are damaged or not functioning, repairs or relocation/redesign must be carried out as a priority.
- Soils to be used for ecological work must be carefully stripped, stored and relocated.
- Works should be carried out to avoid negative effects on nature conservation features (eg individual trees and areas of habitat) remaining within the scheme landtake after construction. Systems to support important habitats and species outside of the landtake (eg features which support wetland habitats) may also need to be designed and implemented.
- Measures such as netting, fencing and systems to treat or contain runoff or spillages (to avoid pollution of sensitive habitats or poisoning of species) should be provided in line with the relevant legislation and guidance. Advice should be obtained from the relevant Statutory Consultees, where designated sites or protected species and habitats are involved.
- Temporary works such as haul roads and access tracks should be restored to either their original condition or an appropriate condition to fit into their new surroundings.
- Permanent wildlife protection measures such as fencing and tunnels must be in place before the project is opened for use.
- Records should be prepared for those undertaking the ongoing maintenance. Details of the aims and objectives set, how the works were carried out, whether changes were made during post-construction maintenance, and the results of any monitoring undertaken during construction should be included.



Heathland at A9 Newtonmore



Newt Fencing, A55, Anglesey

4.4 POST-CONSTRUCTION

- Ongoing maintenance and management should ensure that the aims and objectives for the nature conservation measures (referred to collectively as Special Ecological Measures in the Trunk Road Maintenance Manual) are achieved.
- Monitoring of specialist nature conservation measures should continue for as long as it is necessary to establish whether the aims and objectives of the work have been achieved, or in accordance with any agreement in force.
- The requirements for management and maintenance of the works should be included in the relevant management plan and schedules.
- Records should be kept of the development and success of the project where monitoring has been undertaken. These records should be used to inform other works of a similar nature.



Evan Water River Diversion 2 years after construction: M6 Scotland

CHAPTER 5 BIBLIOGRAPHY

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NATURE CONSERVATION CONTACTS

Statutory Consultees:

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Northminster House
Peterborough
PE1 1UA
Tel: 01733 455000
Fax: 01733 568834
(also has teams based in local area offices)

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Almondsbury
B15 4UD
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Northern Ireland

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Commonwealth House
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Scotland

Scottish Environment Protection Agency
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Scottish Natural Heritage
12 Hope Terrace
Edinburgh
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Countryside Council for Wales
Plas Penrhos
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36 Queen Annes's Gate
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SW1 9AS
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(also has regional offices)

RSPB
The Lodge
Sandy
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G19 2DL
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Fax: 01767 692365
(also has regional offices)

RSPB (Scotland)
17 Regent Terrace
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(also has regional offices)

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ANNEX 1 SEASONAL CONSTRAINTS - ANIMALS

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ANNEX 1: SEASONAL CONSTRAINTS – ANIMALS															
TYPE	MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	COMMENTS	
BIRDS	Breeding		_____											Start of nesting dependent on local variations	
	Overwintering	_____									_____				
AMPHIBIANS	Breeding		_____												
	Hibernation	_____									_____				
REPTILES	Breeding				_____										
	Hibernation	_____										_____			
INVERTEBRATES	Breeding				_____										
	Overwintering (Egg stages)	_____									_____				
BATS	Breeding				_____									Breeding April to June; nursery roosts July to September. Overwintering in hibernacula – sensitive to local variation	
	Overwintering (Hibernacula)	_____										_____			
BADGERS	Breeding		_____											Badgers must not be disturbed between 1 Dec and 30 June as females are in setts with young	
OTTERS	Breeding		_____												

ANNEX 1 SEASONAL CONSTRAINTS - ANIMALS

VOLUME 10 SECTION 6
PART 1 HA 84/01

ANNEX 1: SEASONAL CONSTRAINTS – ANIMALS														
TYPE	MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	COMMENTS
DORMICE <i>(Muscardinus avellanarius)</i>	Breeding						_____							
	Hibernation	_____									_____			
FISH	Salmonidae													Other species which may be of conservation importance may not share the same seasonal constraints
	Adult sea trout						(a)	_____						
	Adult Salmon	_____								(b)				
	Salmon smolts			(c)	_____						(d)			
	Salmon fry													
Coarse fish			(e)	_____										
NOTES	<ol style="list-style-type: none"> The bars indicate the main periods to avoid when undertaking works which affect these species. Consideration should be given to climatic and locational variations, which may bring forward or delay the period. Some animals and their habitats have statutory protection. Where protection is given by legislation advice must be obtained from the relevant Statutory Consultees. 													

KEY to Fish Bars

- (a) Adult sea trout ascend rivers to spawn
- (b) Salmon spawning (but geographical and seasonal variation may extend period into February at some locations)
- (c) Spring migration of salmon smolts to the sea
- (d) Salmon eggs and/or fry in river bed
- (e) Spawning of most coarse fish

In respect of fish, the constraints indicated provide a guide only and variations due to species and season should be considered on a site-by-site basis.

This Annex provides a list of the main relevant conventions and legislation. For further detail the original documents should be consulted and if necessary the relevant specialist advice obtained. For Environmental Assessment legislation DMRB Volume 11 should be consulted.

International Conventions

- Convention on Wetlands of International Importance especially as waterfowl habitat 1971 (The Ramsar Convention)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973 (CITES)
- Council of Europe Convention on the Conservation of European Wildlife and Natural Habitats 1979 (The Berne Convention)
- Council of Europe Convention on the Conservation of Migratory Species of Wild Animals 1979 (The Bonn Convention)
- The Rio Convention on Biological Diversity 1992

European Directives

- 79/409/EEC Conservation of Wild Birds 1979 – established for birds. Special Protection Areas (SPAs) implemented by Wildlife and Countryside Act 1981.
- 92/43/EC Conservation of Natural Habitats and of Wild Flora and Fauna 1992 – established Special Areas of Conservation (SACs). Implemented by Conservation (Natural Habitats &c) Regulations 1994.

UK Legislation

- The Protection of Animals (Scotland) Act 1912
- The Conservation of Seals Act 1970
- The Wildlife and Countryside Act 1981 as amended in 1985, 1988 and 1992
- Wild Mammals (Protection) Act 1996
- Control of Trade in Endangered Species (Enforcement) Regulations 1985
- The Native Conservation and Amenity Lands (Northern Ireland) Order 1985 as amended in 1989
- The Deer Act 1991
- The Protection of Badgers Act 1992
- The Conservation (Natural Habitats &c) Regulations 1994
- The Wildlife (Northern Ireland) Order 1985 as amended in 1995
- The Deer (Scotland) Act 1996
- The Hedgerow Regulations 1997
- Countryside and Rights of Way Act 2000

This Annex provides advice on specific species or groups of species. It should be read along with the relevant parts of the main advice note text.

Mammals:

There are around 50 species of mammal recorded as native or naturalised in the UK.

When considering measures relating to a species of mammal, their behaviour, social interactions and habitat requirements at the various stages of their life cycle must be taken into account. Specialist advice should be sought, especially for protected species.

Issues to be considered when undertaking project design, construction and ongoing management are habitat fragmentation, reduction of road casualties where they are a concern, and habitat management appropriate to maintenance of populations.

Many smaller mammals are important food sources for other species, such as birds. When considering the effects of projects or works, any impact on these prey species should be considered.

Listed below is advice on the main species of conservation interest likely to be recorded on highway land (with proposals to reintroduce mammals, escapees from animal collections and changes in legislation this list should not be considered as definitive).

Badger *Meles meles* (see DMRB Vol 10, Section 4, Part 2 - HA 59/00)

Bats *Chiroptera* (see DMRB Volume 10, Section 4, Part 3 - HA 80/99)

Deer:

Introduction

- There are six species of native or naturalised deer in the UK. Chinese water deer *Hydropotes inermis*; Fallow deer *Dama dama*; Muntjac *Muntiacus reevesi*; Red deer *Cervus elaphus*; Roe deer *Capreolus capreolus* and Sika deer *Cervus nippon*.
- The species range in size from the Chinese water deer (90-100cm head-body length) to the Red deer (165-260cm head-body length).
- Summer and winter coats range from reddish brown to pale greyish brown with various markings depending on species.
- Native deer are widespread throughout the British Isles with large populations in Scotland. Some introduced species have a limited distribution but are currently spreading.

Habitat and Behaviour

- Most species are found in woodlands. Some species have adapted to open landscapes and Chinese water deer to grassland or wetland habitats.
- Red, Sika and Fallow deer form herds. Roe, Muntjac and Chinese water deer live in small groups or as solitary animals.
- Most species are active throughout the day and night.
- They feed on grass, crops, trees and shrubs.
- The mating period (the rut) occurs in late summer/autumn with a single calf (occasionally twins) born in early summer of the following year. The Muntjac has no clearly defined breeding season.

Protection and UK Biodiversity Action Plan Status

- Some species of deer are protected by the Berne Convention, Wildlife and Countryside Act and the relevant national Deer Acts.
- Roe, Red and Fallow deer are listed as Species of Conservation Concern in the UK Biodiversity Action Plan.

Key Roads Related Issues

- Road deaths can be an important consideration for some species in some areas.
- Habitat loss and fragmentation from road construction can be a serious threat to some species in some locations.

Relevant Protection and Mitigation Measures

- Fencing and underpasses/bridges can be used to prevent road casualties where they are a problem. Deer reflectors have also been used as a deterrent, but their effectiveness over long periods is uncertain.
- In situations where road casualties are a major issue, consideration should be given to ensuring planting is kept back from the edge of carriageway to ensure that deer do not bolt unseen across roads.

Dormouse *Muscardinus avellanarius*

Introduction

- Significantly declined in the last 100 years in both numbers and distribution, partly due to habitat destruction and continuing local population extinction, particularly in the north of England. Patchy distribution in Southern England.
- Small rodent, bright orange-brown colour above and paler below, with large eyes, a long, bushy tail and short legs. Head and body length 7cm, tail 7 cm.

Habitat and Behaviour

- Lives in woodlands, hedgerows and areas of scrub, primarily among the branches of trees and shrubs. Ideal habitat comprises mixed species-rich woodland with a continuous shrub layer and tree based linkages to other habitat. Ancient or semi-natural woodland with hazel coppice is most suitable.
- Nests in trees and vegetation and will use nestboxes. Hibernates between October and April, but can temporarily hibernate at other times of the year when food resources are scarce. Feeds on flowers, berries, nuts and insects depending on availability of these foods.
- Nocturnal and lives at low population densities (between 5-10 per hectare in good habitat), making them vulnerable to local population extinction.
- Young born in early summer. Average 2-5 per litter twice a year.

Protection and UK Biodiversity Action Plan Status

- Protected by European Habitats and Species Directive, The Conservation (Natural Habitats &c) Regulations and Wildlife and Countryside Act.
- Priority Species in UK Biodiversity Action Plan.

Key Roads Related Issues

- Habitat loss and fragmentation from road construction, including loss of linkages such as hedges between habitats are serious threats. Habitat loss and fragmentation creates small isolated populations vulnerable to extinction.
- Dormice are difficult to survey. Surveys should aim, in addition to finding out whether dormice are present or not, to identify potential dormouse habitat.

Relevant Protection and Mitigation Measures

- Creation and management of woodland and hedgerows to provide appropriate vegetation and wildlife 'corridors' or linkages between areas of dormouse habitat.
- Specialist survey, protection of habitats and control of construction activities are crucial.

See also DMRB Vol 10 Section 4 Part 5 - HA 97/01 and the Dormouse Conservation Handbook, English Nature (1996).

Otter *Lutra lutra* (see DMRB Vol 10, Section 4, Part 4 – HA 81/99)

Pine Marten *Martes martes***Introduction**

- Widespread across Britain until the 20th century, but significantly declined in distribution and numbers in last 100 years due to habitat loss and hunting.
- Coat is a light tawny to dark brown above and yellowish-white below, including throat and chest. Similar to a mink but with a longer tail. Head and body 30-45cm, tail 22-27cms.
- Confined to the Scottish Highlands and Grampian Region where it is increasing its range. Isolated populations in southern Scotland, Northumberland, North Yorkshire, North and Mid Wales, and in the Lake District.

Habitat and Behaviour

- Prefers mature coniferous or mixed forest with plenty of cover. Also uses scrub covered cliffs, avoiding open areas and clearings.
- Builds several nests or 'dens' throughout the home range, usually in hollows in trees but also in tree roots and rock crevices.
- Mainly nocturnal. Active in daylight during summer.
- Solitary and lives at low population densities (2 per 82 hectares in good habitat) making them vulnerable to local population extinction.
- Feeds mainly on small mammals, birds, beetles, eggs, fruit, carrion and fungi.
- Young born Spring. On average 3 in a single litter.

Protection and UK Biodiversity Action Plan Status

- Protected by Berne Convention and Wildlife and Countryside Act.
- Priority Species in UK Biodiversity Action Plan.

Key Roads Related Issues

- Habitat loss and fragmentation due to road and other developments is a serious threat as small isolated populations are vulnerable to extinction. Road casualties may also be a factor in hindering population recovery.
- Extremely sensitive to human disturbance which makes surveys difficult.
- Disturbance should be avoided during spring and early summer.

Relevant Protection and Mitigation Measures

- Planting and habitat management to encourage pine martens, especially linkages between areas of suitable habitat to reduce further fragmentation.
- Construction activities controlled to prevent indirect impacts (such as vibrational disturbance from heavy machinery or dust generation).

Red Squirrel *Sciurus vulgaris***Introduction**

- Britain's only native squirrel.
- Was widespread in Britain until habitat loss, competition with the introduced grey squirrel and naturally fluctuating food availability led to a drastic decline over the last 60 to 70 years.
- Virtually extinct in southern England except for populations on the Isle of Wight and Poole Harbour. Populations in Wales and central England limited to a few known locations. Relatively widespread in Northern England and Scotland, but in decline.
- Colour varies from bright ginger through to red and dark brown or black tinged with grey in winter. Front and underbelly are paler. Significantly smaller than the grey squirrel, with a bushier tail and ear tufts. Head and body length 18-24cm, tail 17-18cm.

Habitat and Behaviour

- Lives in all types of woodland habitats, but prefers mixed coniferous forests. Can successfully compete against grey squirrels, except in broad-leaved and mixed woodlands.
- Nests in dreys in the tree canopy or in hollow trees.
- Diurnal (active during the day) with most time spent in the tree canopy.
- Feeds on seeds, flowers, shoots and fungi.
- Young born in early spring and summer. Average 3 per litter twice a year.

Protection and UK Biodiversity Action Plan Status

- Protected by Wildlife and Countryside Act.
- Priority Species in UK Biodiversity Action Plan.

Key Roads Related Issues

- Habitat loss and fragmentation from road construction and other developments are important conservation issues as small isolated populations are vulnerable to extinction.

Relevant Protection and Mitigation Measures

- Planting and habitat management to encourage red squirrels and discourage grey squirrels where populations are known to occur.
- In some limited situations, measures to maintain connections across roads have been used (eg squirrel ropes).

Scottish Wildcat *Felis silvestris***Introduction**

- Britain's last indigenous wild cat which colonised Britain approximately 11,000 years ago.
- Widespread in Britain until habitat loss and hunting led to extinction in England and Wales in the 1800s, and a decline in Scotland until the 1920s.
- Undergoing a gradual recovery in Scotland.
- Larger than the domestic cat, short bushy blunt-tipped tail, larger head and longer legs. Head and body length 50-80cm, tail 28-35cm.
- Coat markings are predominantly tabby with distinctive black tail rings and pale paws. Hybrids between the wildcat and domestic cat occur.

Habitat and Behaviour

- Found at high altitude in dense woodland and scrub, on rocky hills and on exposed mountainsides.
- Can climb and swim but stays mainly on the ground.
- Solitary and nocturnal. Nomadic males defend large territories, the size of which are dependent on food resources. However, if food is abundant, they are known to live in groups.
- Feeds on small mammals such as rabbits, vole, mice and roe deer fawns, also birds, eggs and frogs.
- A litter of 3-5 young are born in late Spring, and leave their mother at 4 months old.

Protection and Biodiversity Action Plan Status

- Protected under European Habitats and Species Directive, The Conservation (Natural Habitats &c) Regulations, Berne Convention, and Wildlife and Countryside Act.
- UK Biodiversity Action Plan Species of Conservation Concern.

Key Roads Related Issues

- Road deaths can present a serious threat to wildcat populations where they occur.
- Habitat loss and fragmentation from road construction and other developments are important factors as small isolated populations are vulnerable to extinction and hybridisation with domestic cats.

Relevant Protection and Mitigation Measures

- Seek to reduce habitat fragmentation caused by roads where practicable.
- Consider protection measures to keep wildcats away where road casualties are a major issue.

Water Vole *Arvicola terrestris***Introduction**

- Was widespread and locally common along waterway banks and ponds throughout Britain. Catastrophic decline with local extinction since 1960's through loss and fragmentation of habitat, changes in waterway management, predation by increasing mink populations and water pollution continuing.
- Colouring is usually a rich reddish brown with a lighter yellow grey on the belly. Up to 13.5cm long and weighing approximately 300g. Distinctive "plop" sound when diving into water.
- Found throughout the UK but least numerous in Wales, Devon and Cornwall. Most common in South East England.

Habitat and Behaviour

- Lives in rivers, streams, ditches, canals, lakes and ponds. Swims and dives well, but not generally well adapted to aquatic life as feet are not webbed and fur becomes waterlogged with prolonged submergence. Have been found in road drainage systems where these systems are linked to nearby water vole territories.
- Slow moving watercourses, less than 3m wide, about 1m deep with a small range of water level changes and thickly vegetated banks with earth sides suitable for digging burrows are considered the best habitat.
- Territorial, defending small territories from their neighbours.
- Largely diurnal, but some above ground activity at dawn and dusk.
- Feeds on stems and leaves of waterside plants.
- Young born in spring and summer. Average 5-8, in 2-5 litters annually.

Protection and UK Biodiversity Action Plan Status

- Water Vole habitat, and individuals in burrows are protected by the Wildlife and Countryside Act.
- Priority Species in the UK Biodiversity Action Plan.

Key Road Related Issues

- Populations can be at risk from projects involving waterbody vegetation clearance or bankside work. Surveys to ascertain presence and habitat usage to be undertaken where populations are likely to exist.
- Creation of new wetlands and maintenance of drainage systems may provide an opportunity to conserve and enhance habitats.
- Where mink are found on highway land in the same area as water voles, control of the mink may need to be undertaken in conjunction with adjacent landowners.

Relevant Protection and Mitigation Measures

- Avoidance of water vole habitats, wherever possible. Sensitive management of suitable habitat if required.
- Management and enhancement of existing river banks.
- Translocation of individuals as a last resort.

See also Environment Agency (1999) Water Vole Conservation Handbook.

Birds**Introduction**

- Around 500 species of birds reside either temporarily or permanently within the British Isles, but not all of them are found on or near roads.
- The majority are protected by law (especially during breeding seasons) with certain exceptions for game species, and those regarded as pest species. Several groups of birds are given extra protection due to their rarity and recent decline. These include groups such as the waders, owls and birds of prey.
- When considering measures relating to a specific species, their behaviour, social interactions and habitat requirements must be taken into account.

Habitats and Behaviour

- Birds are found across a wide range of habitats. Some species can require specific habitat types, while others utilise a range of habitats. Some birds are solitary unless breeding, others can be gregarious.
- Food sources vary. Some species need specific types of food, others will eat whatever is available.
- Most birds that breed in the UK lay eggs in early spring and may raise several broods through spring into early summer.

Protection and UK Biodiversity Action Plan Status

- Protected by the following legislation which applies to some or all species, and in some cases their habitats: Berne Convention; Bonn Convention; European Birds Directive; European Habitats and Species Directive; The Conservation (Natural Habitats &c) Regulations and The Wildlife and Countryside Act.
- 204 species are listed in the UK Biodiversity Action Plan, 26 species as Priority Species.

Key Roads Related Issues

- Road casualties can be a particularly important issue for birds such as barn owls which hunt over roadside verges.
- Disturbance, light pollution and contamination of food by road salt can have effects on some species.
- Habitat loss and fragmentation from road construction and other developments can have serious negative effects on some species.
- Air and water pollution can have negative effects on some species due to prey eaten by those birds, although the links between road use and these effects is not clear.

Relevant Protection and Mitigation Measures

- Work should be undertaken outside bird nesting periods to avoid disturbance.
- Highway land where appropriate could be managed to encourage invertebrates and other prey items, seeds for feeding, and to provide nesting sites. Nest boxes could be used where appropriate.
- Projects should seek to reduce the effects of light, noise, and visual disturbance in the vicinity of sensitive and protected bird habitats. This could be achieved through specific measures (eg full cut off lighting, planting food sources away from the edge of the road (if possible away from the flow of traffic) and providing buffers or screens where practical).

See also **De Feu** (1993) Nest boxes, British Trust for Ornithology.

Reptiles**Introduction**

- There are 6 native terrestrial species of reptiles in the UK - Slow worm (*Anguis fragilis*), Smooth Snake (*Coronella austriaca*), Adder (*Vipera berus*), Grass Snake (*Natrix natrix*), Sand Lizard (*Lacerta agilis*) and Common Lizard (*Lacerta vivipara*).
- Reptiles are cold-blooded, air breathing and dry skinned. They require heat to help maintain a constant body temperature, and achieve this by basking in the sun.

Habitats and Behaviour

- Species live within a wide range of habitats including rank grasslands, woodlands, heathland, sand dune systems and some wetland areas. They have also been found in roadside drains where the surrounding habitat is suitable.
- Species need bare surfaces (especially rock surfaces) warmed by the sun to raise body temperature. Hibernation occurs during winter months, October to March.
- Reptiles feed on a wide range of invertebrates and small vertebrates
- Some species are egg layers, others lay live young with births usually expected in early autumn.

Protection and UK Biodiversity Action Plan Status

- Protected by the following legislation which applies to some or all of the species, and in some cases, their habitats; Berne Convention; European Habitats and Species Directive; The Conservation (Natural Habitats &c) Regulations and The Wildlife and Countryside Act.
- All species, except the Common Lizard are listed in the UK Biodiversity Action Plan. The Sand Lizard is listed as a Priority Species.

Key Roads Related Issues

- Disturbance during project construction and ongoing maintenance.
- Habitat loss and fragmentation, and the possible loss of food sources from pollution, unsympathetic management (eg inappropriate grass cutting) and project construction.

Relevant Protection and Mitigation Measures

- Following appropriate survey, careful planning of habitat management practices on suitable sites should be undertaken in advance of any works.
- Suitable mitigation measures (eg provisional hibernacula) to avoid or minimise negative effects such as habitat loss or fragmentation and disturbance, should be included within project design.

Amphibians**Introduction**

- There are currently 6 native amphibians in the UK, although other species can be found as escapees or introductions. The 6 species are - Common Frog (*Rana temporaria*), Natterjack Toad (*Bufo calamita*), Common Toad (*Bufo bufo*), Great Crested Newt (*Triturus cristatus*), Palmate Newt (*Triturus helveticus*) and Smooth Newt (*Triturus vulgaris*). The status of the pool frog (*Rana lessonae*) is under investigation.
- Amphibians are part aquatic/part terrestrial, cold blooded, air breathing vertebrates with damp permeable skin which needs moisture to function effectively.
- Species can be widespread (eg Smooth Newt) or locally distributed (eg Natterjack Toad).

Habitat and behaviour

- Some species rarely migrate far from breeding sites and can be found within a wide range of habitats in the nearby landscape (eg woodland, heathland, sand dunes, saltmarsh and grassland) especially during the adult stages and overwintering.
- Food consists of small aquatic and non-aquatic invertebrates, with some species passing through a herbivorous aquatic stage.
- Breeding is in an aquatic environment and is often accompanied by courtship displays and vocalisations. Eggs laid in early spring lead to young adults in early summer.

Protection and UK Biodiversity Action Plan Status

- Protected by the following legislation which applies to some or all species; Berne Convention; European Habitats and Species Directive; The Conservation (Natural Habitats &c) Regulations and The Wildlife and Countryside Act.
- All 6 species are included in the UK Biodiversity Action Plan.
- Handling of the Great Crested Newt and Natterjack Toad in England, Scotland or Wales requires a licence from the Statutory Consultee. The Smooth Newt in Northern Ireland also requires a licence.

Key relevant road issues

- Habitat loss and fragmentation from road projects, unsympathetic management practices and pollution.
- Disturbance associated with road construction, operation and management, and human presence.
- Introduction of fish into breeding ponds.
- Road deaths associated with migration to and from spawning sites.

Relevant Protection and Mitigation Measures

- Mitigation to prevent habitat loss or fragmentation (eg amphibian underpasses and fencing, construction of ponds/hibernacula).
- Careful planning and application of habitat management practices, based on data appropriate survey or other information on the species present.
- Appropriate measures should be used to ensure that the relevant water quality objectives where available are maintained when routine runoff is discharged into receding waters, or where the risk of spillage is present.
- Inclusion where land is available for buffer zones around suitable habitats to protect against disturbance.
- Installation of appropriate fences for protected species during project construction.

See also DMRB Vol 10 Section 4 Part 6 - HA 98/01, English Nature (1996) Natterjack Toad Conservation Handbook and JNCC (1998) Herptofauna Workers Manual.

Fish**Introduction**

- There are currently 38 species of fish in the UK which live part, or all of their lives in freshwater. 300 species are found in marine habitats.
- Fish species are widespread throughout the UK, but some rare and protected species may be restricted in distribution (eg to individual lakes).
- Fish are cold blooded, gill breathing aquatic vertebrates with bony or cartilaginous skeletons.

Habitat and Behaviour

- Fish occur in all types of water, including freshwater lakes, ponds, canals, rivers, drains, estuaries, coastal areas and open sea habitats.
- Some species, many of which are migratory, spend time in more than one type of water habitat, or require different habitats at different life stages.
- Some migratory species have a need to return to original spawning grounds, which means that even where rivers have been altered, species will attempt to overcome any obstacles, regardless of the consequences to themselves.

Protection and UK Biodiversity Action Plan Status

- Some species are protected by the following legislation: Berne Convention; European Habitats and Species Directive; The Conservation (Natural Habitats &c) Regulations and The Wildlife and Countryside Act.
- Currently 26 species are included in the UK Biodiversity Action Plan. Nine species and 2 groups of marine fish are priority species.

Key relevant road issues

- Species can be vulnerable to direct and indirect effects of pollutants in water (eg heavy metals, pesticides and spillages). This may in turn cause problems for species which eat fish.
- Pollution in lower reaches of rivers and estuaries may affect migratory fish requiring higher oxygen levels, and prevent them from reaching breeding grounds.
- Habitat loss through inappropriate works on rivers or waterbodies near roads.
- Siltation of spawning sites from project works can reduce the amount of oxygen available to fish eggs.

Relevant Protection and Mitigation Measures

- The identification of key river spawning sites and migration routes should be an important aim of any survey.
- The design of appropriate mitigation must include measures for protection of habitat and migration routes, in addition to any longer term mitigation.
- Habitat and migration route protection must be in place before construction starts.
- Appropriate measures should be used to ensure that the relevant water quality objectives, where available, are maintained when routine runoff is discharged into receding waters or the risk of spillage is present.

See also Scottish Executive (2000) Rivers Crossings and migratory fish: Design Guidance.

Invertebrates**Introduction**

- Approximately 30,000 species of invertebrates live in the UK, ranging from ants, bees, spiders and flies through to snails, butterflies, crickets and beetles.
- Invertebrates can be found in almost any habitat (including marine environments), although some have very specific habitat and food requirements. They are often crucial to the maintenance of many habitats and other species.

Habitats and Behaviour

- Although species can be found in almost any habitat, grassland, heathland, veteran trees and wetland can be of particular importance. Sites containing a mosaic of habitats (ie including a varied vegetation structure and bare ground) can support a wide range of invertebrates, although for some species the habitat and even host plant/animal can be very specific.
- Invertebrates often have complex annual life cycles, and in order to survive need suitable habitat conditions for all life stages, including breeding and overwintering.

Protection and UK Biodiversity Action Plan Status

- Some species are covered by the following legislation: Berne Convention; European Habitats and Species Directive; The Conservation (Natural Habitats &c) Regulations and The Wildlife and Countryside Act
- Currently around 470 species are included in the UK Biodiversity Action Plan. 329 species are Priority Species.

Key Roads Related Issues

- Some species have poor dispersal and colonisation abilities and therefore can be vulnerable to the effects of habitat loss/fragmentation and barriers to movement.
- Some invertebrate species are vulnerable to air and water pollution, pesticide use and other rapid environmental fluctuations.
- The importance of road casualties on terrestrial invertebrate populations is unknown.
- Roads and traffic can be the mechanism by which some species can spread (eg crickets).

Relevant Protection and Mitigation Measures

- Designs should include mitigation to prevent habitat loss or fragmentation and must include the ongoing management of roadside verges to maintain suitable habitat.
- Designs should seek to achieve the relevant requirements for the species involved, or where there is no specific target species, seek to achieve the maximum diversity of habitats to meet the widest range of invertebrate requirements (eg water, bare ground, deadwood, diverse vegetation structure).
- Appropriate measures should be used to ensure that the relevant water quality objectives where available are maintained when routine runoff is discharged into receiving waters or the risk of spillage is present.

Plants**Introduction**

- There are currently approximately 39,000 plant or plant-like species (including algae, fungi, mosses, liverworts, ferns, horsetails and flowering plants (trees and shrubs)) native or naturalised in the UK.
- Plants, and the diversity of plants in a particular area, reflect the influence of many interrelated factors such as soil, hydrology, climate and type of management (either natural or by humans). Some species have very specific requirements, while others have adapted to almost any situation.
- Plants form the basic material on which most other species survive. Some plant species have evolved very complex life cycles or behaviour based on an interaction with other species.
- Some introduced plant species have become a major pest, affecting nature conservation interests and other land use (eg Ragwort, Japanese knotweed, Canadian pondweed, Himalayan Balsam, Giant hogweed).

Habitat

- Plants can be found in almost any habitat, wherever sufficient resources can support their requirements.
- Some plants have developed a short life cycle which allows accelerated reproduction in order to survive in an ever changing environment; others have developed a long life cycle which requires more stable environmental conditions.
- Very few plants live in single species communities.

Protection and UK Biodiversity Action Plan Status

- Some plant species are covered by the following legislation: Berne Convention; European Habitats and Species Directive; The Conservation (Natural Habitats &c) Regulations and The Wildlife and Countryside Act.
- There are currently around 470 species included in the UK Biodiversity Action Plan. 250 species are Priority Species.

Key Road Related Issues

- Habitat loss or fragmentation, and inappropriate management can cause loss of species. Grassland and wetland plant communities are particularly vulnerable to these effects. Such isolation and loss of species diversity can result in localised extinctions.
- Roads can provide the mechanism by which species spread. This can be beneficial or detrimental to the environment depending on the species involved.
- Some plants are sensitive to pollution (eg lichens).
- Changes to factors which affect plants (eg drainage system changes which affect water availability) can cause significant problems for maintaining species or communities of species.

Relevant Protection and Mitigation Measures

- Measures such as mitigation, creation and enhancement should take into account the wider community and habitat in which the plant species are found. Careful consideration must be given to replicating, as near as possible, the habitat requirements for protected and rare species.
- Construction and ongoing management work must be planned to ensure that measures are taken to protect rare or protected species.

This Annex provides advice on specific habitats. It should be read along with the relevant parts of the main advice note text.

Wetland & Aquatic Habitats:**Introduction**

- Aquatic habitats are widespread, although some types of habitat are very rare. Saltwater habitats include areas of open sea, rocky shores and estuaries. Freshwater habitats include rivers, streams, ponds, lakes, fens, mires and marshes. In some habitats the balance of fresh, brackish and saline water is crucial to the maintenance of the habitats and related species.
- Wetlands provide habitat for a wide range of plants, invertebrates, fish, and larger animals including rare, threatened and endangered species.
- Internationally important wetland habitats can be designated as Ramsar sites, Special Areas of Conservation (SACs) or Special Protection Areas (SPAs) depending on the nature conservation interest involved. National designations include Sites of Special Scientific Interest (SSSIs) and Marine Nature Reserves (MNRs).
- A range of wetland and aquatic habitats are protected under the European Habitats and Species Directive and are included in the UK Biodiversity Action Plan.
- Wetlands and aquatic habitats can be affected by pollution, erosion from surrounding land and inappropriate management.

Design issues

- Designs for wetland/aquatic habitats must take into account all relevant biotic factors, which will affect the success of the design (eg hydrology of the site and the surrounding area, available water resources, climate, opportunities for natural colonisation etc).
- Some types of wetland are easier to create/re-create than others (eg some types of lake or pond) while others are very complex (eg species rich wet grasslands, mires and fens). Specialist advice should be obtained in relation to site specific design.
- Ditches, culverts and balancing ponds may attract a nature conservation interest (see DMRB Volume 10 Section 1 Part 1 HA 55/92 - Landform and Alignment). Management should be designed to maintain their operational function. Where protected species are known to be present, the relevant Statutory Consultees should be consulted before any works are carried out.
- Consideration should be given to using areas designed to store or contain river floodwaters for wetland creation.

Grassland:**Introduction**

- Grassland can be a stage in the natural progression of vegetation towards scrub or woodland. Grasslands reflect the geological, soil and climatic conditions which support them. Appropriate management is required on some types of nature conservation grassland to ensure that the botanical interest is maintained.
- Species-rich grasslands are increasingly rare, especially on restricted soils (eg chalk and magnesian limestone).
- Grasslands can support protected and rare species (eg adders, orchids and some butterflies), and provide habitats which support important numbers of species which provide food for other rare species (eg raptors feeding on small mammals in rough grassland).
- A number of hay meadow grasslands are protected under the Habitats Directive. The UK Biodiversity Action Plan covers a range of species-rich grassland types.

Design Issues

- The Wildflower Handbook (Volume 10 Section 3 HA 67/93) should be consulted in conjunction with this advice note, and specialist advice should be obtained where grasslands of high conservation interest are involved, or planned.
- Species-rich grassland can require specific conditions (eg soil depth and type, and water availability) and ongoing management to ensure its establishment and continuance.
- Designs should be based on appropriate survey information of the site's characteristics and its surroundings, and take into account the relevant levels of ongoing management that will be required.
- Species-rich grassland designs should not include the area immediately adjacent to the road carriageway so as to avoid any potential pollution effects.
- A site-specific seed mix of appropriate provenance should be used which reflects the characteristics of the site and surrounding area.
- Seeding should be carried out to coincide with the most suitable germination conditions for the majority of grassland species.
- Grassland translocation is most appropriate and effective in dry grassland and heath areas where large turves can be moved. Specialist advice should be obtained in relation to any translocation.

Heathland:**Introduction**

- The area and ecological value of heathland in the UK has been dramatically reduced through habitat loss and fragmentation.
- Heathland vegetation occurs naturally on acidic, sandy, nutrient-poor soils, and is dependent on the maintenance of low levels of soil nutrients, particularly phosphorus and nitrogen.
- Heathland can support protected and rare species (eg reptiles, amphibians and birds such as Dartford Warbler and Nightjar) which are sensitive to their surroundings and human disturbance.
- Heathland is included in the European Habitats and Species Directive and the UK Biodiversity Action Plan.

Design Issues

- Disturbance to heathland should be avoided wherever possible. Where this is unavoidable, appropriate mitigation and creation measures should be implemented.
- Appropriate specialist advice should be obtained.
- Design for mitigation and creation should be appropriate to the site conditions and the surrounding area, and be capable of being maintained.
- Trees are not usually appropriate for heathland areas but may provide resting sites for heathland birds.
- Suitable seed sources for heathland may be in short supply. Chopped up fragments of heathland vegetation and surface soil (blading) from site clearance can be used instead of seeds in some circumstances.
- Upland heathland recreation can quickly establish where this habitat was formally present and where the original soil remains in-situ. In other locations establishment may take longer, but fertilisers should not be used to accelerate establishment. Instead an appropriately provenanced non-aggressive annual grass seed mix may be sown to reduce soil erosion.

Woodland and Scrub:**Introduction**

- Woodland and scrub can be found across the UK in a variety of situations.
- Some types of woodland are relatively easy to create/recreate. Others are more difficult, if not impossible to create/recreate within the realms of current knowledge, due to the presence of complex ecological structures and interactions (eg those in mature woodland).
- The value of woodland and scrub for nature conservation can relate to a number of factors including: vegetation structure; species diversity; climatic conditions within the vegetation; and the management regime. The value can also relate to the complexity of the wood in its setting or sometimes to individual trees.
- Some types of woodland are covered under the European Habitats and Species Directive and the UK Biodiversity Action Plan.

Design Issues

- Crucial factors in the design of woodland and scrub are the choice of appropriate species for the site and its surroundings; and the purpose of the planting. An easily executable planting design and appropriate ongoing management plans are also essential.
- Long term aims and objectives, which cover the expected life of the planting should be used to guide the design process.
- Woodland planting, in addition to its nature conservation value, can help integrate the road into the landscape, provide visual interest and screen the project from surrounding areas.
- Native trees and shrubs used should have an appropriate UK provenance.
- New techniques involving complete bole removal, allowing specimen trees to be entirely removed and relocated with minimal disturbance, can be used in some cases.
- It can be difficult to establish appropriate woodland ground flora. An appropriate woodland structure should be provided where there is an opportunity for flora to spread from adjacent areas. Plant plugs or seeding can be successful in some circumstances.
- Any design or management proposal should seek to provide a variety of habitats within the planting, including where appropriate a mixture of vegetative structure, different microclimates, rides and scalloped edges and deadwood. Individual trees could be chosen to provide a long term woodland resource (eg veteran trees for the future).

Rock Faces and Scree:**Introduction**

- Rock faces and screes can provide unique habitats for nature conservation in both terrestrial and marine habitats.
- Some very specialised rock and scree habitats are included in the European Habitat and Species Directive. Marine related rock faces and screes are also included in the UK Biodiversity Action Plan.
- Rock faces can provide a landscape feature in addition to their nature conservation interest.

Design issues

- Establishing the right conditions for plant growth on exposed rock outcrops is discussed in DMRB Volume 10 Section 1 Part 1 HA 55/92 - Landform and Alignment and Section 1 Part 2 HA 56/92 - Planting, Vegetation and Soils.
- Roads passing through rock cuttings can provide opportunities to create this habitat type where appropriate and safe to do so.
- Rock faces and scree with numerous small ledges and varied micro-topography can allow plants, tolerant of high stress conditions and low fertility, to establish.
- Natural regeneration can be the most successful method of plant establishment but where there are no nearby seed sources to facilitate this, application of suitable seed at low density may be appropriate (eg by hydroseeding).

Walls:**Introduction**

- Walls can contain a wide range of habitats, depending on the material used.
- In some cases walls can provide re-colonisation routes for lichens, mosses, liverworts and ferns. Invertebrates and small mammals which find shelter in walls, can be important food for other species.
- Walls can consist of a variety of materials both hard and vegetative, which reflect the local distinctiveness of the surroundings.
- Walls are included in the UK Biodiversity Action Plan as Boundary Features.

Design Issues

- When replacing or rebuilding walls in conservation areas or in other distinctive landscapes, local material should be used whenever possible. Using dismantled existing wall stones and employing the same techniques for building the wall, offer the best chance of natural regeneration.
- Project works or ongoing management which affect walls with existing nature conservation interest, need to take into account the effect of individual operations.

Hedgerows and Hedgebanks:**Introduction**

- Hedgerows and hedgebanks are important habitats for a number of species and can be distinctive features in the landscape.
- The Hedgerow Regulations 1997 protect “important” hedges and their associated banks and walls.
- Hedges and Hedgebanks are included in the UK Biodiversity Action Plan as Boundary Features.

Design issues

- Hedges can offer an opportunity to maintain and enhance existing nature conservation links and landscape character.
- Guidance for planting new hedges is included in DMRB Volume 10 Section 1 Part 2 HA 56/92 - Planting, Vegetation and Soils.
- New hedges or hedgebanks should reflect or improve where appropriate the species diversity and composition of neighbouring hedges. The design must ensure that the appropriate materials are used to reflect local distinctiveness and that ongoing management can be provided.
- Hedgerow trees can be planted with a new hedge, but must be marked to ensure they are not cut during ongoing maintenance.
- The transplanting of hedgerows has been successful in some cases. However, it should only be considered for significant hedgerows, which cannot be replaced, and only after appropriate specialist advice has been obtained.

Vegetated Shingle:**Introduction**

- Vegetated shingle is a rare and declining habitat within the UK. It can be marine or terrestrial (eg next to a lake or in a gravel pit).
- Vegetated shingle can provide a valuable habitat for flora and fauna, most notably invertebrates and birds. It can support a floral community which is not found in surrounding areas.
- Vegetated shingle is included in the European Habitats and Species Directive and in the UK Biodiversity Action Plan.

Design Issues

- Successful shingle habitat creation depends on an appropriate design which reflects the surrounding area. Shingle habitat creation is difficult as relatively little research has been carried out in this area. Appropriate expert advice should be obtained.
- Suitably sized shingle from an appropriate source, with the right level of nutrient organic matter and pattern of ridges and furrows can determine the ability of the area to sustain the establishment and growth of a shingle flora and fauna.

Inter-tidal Mudflats:**Introduction**

- Inter-tidal mudflats can be found along coastlines and estuaries where tidal action allows the sedimentation of fine mud and silts.
- Mudflats often merge into other habitats such as saltmarsh further up the shoreline.
- Mudflats can be affected by rising sea levels and land claims resulting in “coastal squeeze” where there is no opportunity for re-establishment in other locations.
- They can be affected by changes in the quality and quantity of silt and water within them; and by changes to the processes which maintain them.
- Inter-tidal mudflats usually contain significant numbers of marine invertebrates and animals (eg molluscs), which in turn can provide a key source of food for wildfowl and waders, both resident and migratory.
- Mudflats can be designated sites, and as habitats are included in the European Habitats and Species Directive and the UK Biodiversity Action Plan (as part of the Estuary Action Plan). Some of the species which depend on mudflats can be protected themselves.

Design Issues

- Where road infrastructure unavoidably affects mudflats careful consideration must be given to the dynamic processes which are influencing the mudflat. This is particularly important if recreation is to be carried out as influences such as material type, grain size, tidal action and organic matter content can affect the ecological value of the habitat. 'Seeding' with material from surrounding areas, can assist recreation and colonisation by flora and fauna in some circumstances.
- Specialist advice should be sought, and consultation held with the relevant Statutory Consultees where roads are likely to affect mudflats.

Coastal Sand Dunes:**Introduction**

- Coastal sand dunes form where there is a sufficient supply of sand which is blown landwards and deposited above the high tide levels.
- Sand dunes can support a wide range of species including a number of specialised plants and animal communities. Some species can be restricted to the dunes themselves (eg Natterjack Toads).
- The composition of dune systems is influenced by both land and sea and climatic conditions. Habitats can range from pure sand to heath or scrub, with the influence of the sea varying according to season and situation.
- Coastal sand dunes are included in the European Habitats and Species Directive and the UK Biodiversity Action Plan.

Design Issues

- Where road infrastructure unavoidably affects dunes careful consideration must be given to the processes which are influencing the character and development of the dunes. This is particularly important if recreation is to be carried out. Although there have been a number of projects to recreate or stabilise dunes, the processes involved in dune ecology can be complex and need to be considered on site by site basis.
- Specialist advice should be sought, and consultation held with the relevant Statutory Consultees where roads are likely to affect coastal sand dunes.

Sea Walls:**Introduction**

- Sea walls can provide a range of habitats for specialist salt tolerant species.
- Sea walls can include areas which are sub-tidal or inter-tidal which may be of importance for marine algae and invertebrates, especially in areas devoid of similar habitats.
- Sea walls can be constructed from hard materials such as rock or concrete, or a range of softer materials such as earth and clay, which are usually maintained as short grassland.
- Crevices in hard sea walls can provide habitat for a variety of invertebrates, small mammals and birds.

Design Issues

- Where road infrastructure unavoidably effects seawalls, consideration must be given to the role of the wall in maintaining flood defences. Consultation must be carried out with the relevant sea defence organisation before any work is considered or carried out.
- Specialist advice should be sought, and consultation held with the relevant Statutory Consultees where roads are likely to affect the nature conservation value of a sea wall.

Saltmarshes:**Introduction**

- Saltmarsh can be found in areas where fine sediments are deposited in more sheltered parts of coastlines and estuaries.
- Saltmarsh can be influenced by both land and sea based processes which can create a range of differing levels of salinity within one area. This in turn can lead to a range of species being present which are adapted to these specialist conditions. Saltmarshes can be managed by grazing or may be left unmanaged.
- Saltmarshes can provide important feeding and roosting areas for resident and migratory birds, as they are rich in food sources (eg vegetation and invertebrates) for these species.
- Saltmarsh can be threatened by 'coastal squeeze', due to rising sea levels and land claims.
- Saltmarshes can be designated sites. The habitat is included in the European Habitats and Species Directive and the UK Biodiversity Action Plan.

Design Issues

- Where road infrastructure unavoidably affects saltmarsh, careful consideration must be given to the range of habitats and the processes which maintain them. This is particularly important if recreation is to be carried out, as influences such as salinity levels, type of material and tidal processes can affect the ecological value of the habitat. 'Seeding' with material from surrounding areas, can assist recreation and colonisation by flora and fauna in some circumstances.
- Specialist advice should be sought, and consultation held with the relevant Statutory Consultees where roads are likely to affect saltmarshes.

Urban:**Introduction**

- Urban environments can contain areas of open space and specialist habitats. These areas often have unique characteristics such as continual food sources, warmer temperatures than surrounding countryside and areas which are undisturbed and likely to be found in other natural habitats.
- Some areas may have a mosaic of habitats within relatively small areas which can provide valuable breeding, foraging and shelter sites for both birds and mammals, including in some cases protected species.
- Urban sites can have an importance to local people as places for open space, due to their local distinctiveness and historical interest, and as places for recreation.
- Urban habitats are included in the UK Biodiversity Action Plan.

Design Issues

- Designs should be based on the existing nature conservation interest in surrounding areas and their importance to local communities.
- Designs should include elements to increase the connectivity of habitats for wildlife where appropriate.
- In some cases naturally seeded derelict land (eg demolition sites, disused railway land) could be included within the boundaries of a project and maintained for its nature conservation value.

8. ENQUIRIES

All technical enquiries or comments on this Advice Note should be sent in writing as appropriate to:

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