

SOMERSET HIGHWAYS

BIODIVERSITY MANUAL



October 2015

Somerset Highways Biodiversity Manual

2015-2020

**Part of the Somerset County Council
Highways Network Management Plan**

Version 2.2

Contents

1	Introduction	5
1.1	Purpose	5
1.2	Somerset's Biodiversity.....	5
1.3	Biodiversity Value of the County Network	6
1.4	What this Manual Covers	7
2	Legislation & Policy	8
2.1	The Conservation of Habitats and Species Regulations, 2010.....	8
2.2	Wildlife and Countryside Act, 1981	10
2.3	Countryside and Rights of Way Act, 2000.....	10
2.4	Natural Environment and Rural Communities Act 2006	11
2.5	Hedgerow Regulations, 1997.....	11
2.6	Protection of Badgers Act, 1992	11
2.7	Weeds Act, 1959	12
2.8	Wild Mammals (Protection) Act, 1996.....	12
2.9	Town and Country Planning (Trees) Regulations, 1999.....	12
2.10	Salmon and Freshwater Fisheries Act, 1975.....	12
3	Effects of Road Works on Biodiversity.....	13
3.1	Disturbance	13
3.2	Street Lighting.....	14
3.3	Habitat Loss.....	14
3.4	Habitat Fragmentation	14
3.5	Barrier.....	14
3.6	Pollution.....	15
3.7	Hydrological changes.....	15
3.8	Soil changes	15
3.9	Changes in numbers of predators and/or prey	15
3.10	Introduction of new habitats	16
4	General Issues Arising from Highways Maintenance Operations.....	16
5	Planning Work to Take Account of Biodiversity	17
5.1	Establishing Known Constraints and Likely Impacts on Biodiversity.....	17
5.2	Requirements for Works Affecting Designated Sites	22
5.3	Consideration of Other Sites	23
5.4	Important Habitats and Features.....	25
5.5	Important Species.....	27
6	Generic Methods to Take Account of Biodiversity	33
6.1	General Matters.....	33
6.2	Finding Protected Species	34
6.3	Grass Verges.....	34
6.4	Hedgerows	36
6.5	Trees	39
6.6	Scrub and Saplings.....	41
6.7	Planting and Sowing	41
6.8	Visibility Splays	42
6.9	Drainage and Soil Movement.....	42
	(including verge excavation, the creation and maintenance of ditches, grips, gullies, balancing ponds, service tunnels, trenches and pits)	42
6.10	Pot-hole Repair, Patching and Minor Highway Subsidence.....	44
6.11	Kerbing	44
6.12	Bridges and Structures	45
6.13	Street Lighting.....	46
6.14	Surface Treatments	47
	(including surface dressing and slurry sealing)	47
6.15	Miscellaneous Highway Structures & Furniture	47

(crash barriers, fences, signs, waymarks, stiles, gates and cattle grids)	47
6.16 Storage and use of equipment and materials	48
6.17 White Line and other Painting	48
6.18 Gully emptying and Drain Jetting Operations	49
6.19 Winter maintenance	49
6.20 Control of Injurious Weeds	49
6.21 Eradication of non-native plants	51
6.22 Dealing with Emergencies	53
7. Planning for Species – Design, Working Method and Licensing	53
7.1 Introduction	53
7.2 Bats	53
6.3 Common Dormouse	64
7.4 Otter	68
7.5 Great Crested Newt	70
7.6 Water Vole	73
7.7 Badger	75
7.8 Nesting Birds	80
7.9 Barn Owl	83
7.10 Reptiles	85
7.11 Amphibians	88
7.12 Atlantic White-clawed Crayfish	90
7.13 Lesser Silver Water Beetle (and other aquatic invertebrates)	93
8 Enhancement Measures for Biodiversity	95
8.1 Habitat Creation	96
8.2 Sustainable Drainage Systems (SUDS)	96
8.3 Bird Boxes	97
8.4 Bat Boxes	97
8.5 Bat Bricks and Crevices	98
8.6 Common Dormouse	98
8.7 Otter	99
8.8 Water Vole	99
8.9 Amphibians and Reptiles	99
8.10 Underpasses for Mammals/Amphibians/Reptiles	100
8.11 Invertebrates	100
8.12 Signing	101
8.13 Reflective Posts	101
8.14 Deer Collision Prevention	101
References	103
Contacts	108
Appendix 1 - Notice and Assent Agreement for SSSIs (Roads & RoW)	109
Appendix 2 - Specification for Animal Underpasses	110

1 Introduction

1.1 Purpose

The Somerset Highways Biodiversity Manual (SHBM) is a guide by which biodiversity is taken account of in the planning and carrying out of all highway maintenance operations on county roads; new highways schemes; and Rights of Way work in Somerset. It is also an important part of the County Council's Highways Network Management Plan (HNMP).

The SHBM is an updated version of the Somerset Highways Biodiversity Action Plan (2005) and is now seen as a manual to guide work in the highway where it impacts on biodiversity. It also brings in contents from the Somerset Highways Species Action Plans (2006) into one document.

The aim of the SHBM is to help the County Council achieve its objectives, obligations and duties for conserving and where possible enhancing biodiversity in its role as highway authority. The SHBM is an important part of the County Council's implementation of its general biodiversity duty to have regard for biodiversity whilst carrying out its functions (a requirement of the Natural Environment and Rural Communities Act 2006).

The strategic objectives of the plan are:

- To raise awareness of biodiversity matters affecting highways work
- To ensure highway activities operate within wildlife law
- To reduce the extra costs and delays from not identifying biodiversity issues at the earliest appropriate stage
- To set out practical and realistic activities that will contribute to the protection and enhancement of biodiversity

1.2 Somerset's Biodiversity

'Biodiversity' means the richness and variety of life. It comprises ecosystems, habitats and species. It is not restricted to what is rare or threatened, but includes the whole of the natural world. Our quality of life is greatly enriched by biodiversity. It maintains the health of the earth and its people. It contributes to our economy, such as by attracting tourists to the countryside, and provides us with food and medicine. Many of our outdoor pursuits such as bird watching, fishing, walking and photography are reliant on biodiversity.

Somerset is a highly diverse county. The Somerset Environmental Records Centre produced a report (2004) on the biodiversity within Somerset compared with the rest of the UK, which concluded, *'The results show that Somerset and each of its districts has significantly more UK Biodiversity Action Plan (BAP) species present than would be expected for their respective areas.'*

The total number of UK BAP species recorded, 85, represents over a fifth of the UK total list. Since the area of Somerset is less than 2% of the area of the UK and many

of the UK BAP species are very rare and localised, this appears to be a significantly high figure.'

The County is particularly special for its extensive wetlands, with the Somerset Levels and Moors being internationally significant, its herb rich grassland, upland moorland and heathland, upland oak woodland, old orchards and species-rich hedgerows. Somerset also has many important species including twenty-four endemic species (only found in Britain) – five of which are known only from Somerset, including the hairy click beetle found only on the River Parrett. Seven globally threatened species including the aquatic warbler, the large blue butterfly, and many rare or local species such as the otter, common dormouse, greater horseshoe bat and stag beetle are present. The county's biodiversity is a precious resource that needs protecting and enhancing for the future.

1.3 Biodiversity Value of the County Network

There is a diversity of habitats within and associated with the county highway network. The County network consists of 660 kilometres of 'A' roads and 5840 kilometres of other roads, a large proportion of which have verges supporting habitats that may be of value to wildlife. The habitats are usually small, linear and narrow in extent but within and next to larger route layouts there are some more extensive areas. Highway habitats consist mainly of various types of grassland, but woodland and scrub is also common. Routes can also pass through, over or next to other habitats such as woodland, wetlands, rivers and estuaries. Man-made features associated with highways can be important for biodiversity, such as boundary trees, rocky cuttings, bridges, ditches and balancing ponds.

As with churchyards, highway land can sometimes support remnants of ancient habitats and features, for example old meadows on verges and species-rich hedgerows. They are often refuges for wildlife and can act as corridors that connect wildlife and habitats across the county. Highway land can be valuable if it is adjacent to international, national and local sites designated for their nature conservation importance.

Somerset also has one of the largest Rights of Way networks in the country (6038km), which provides public access to the countryside and often passes through valuable wildlife habitats.

The biodiversity value of highway land in Somerset is poorly known but an estimate of the most likely species and habitats that it supports can be made. A number of designated sites occur within highway limits and/or have a highway running through them. The government (see www.naturalengland.org.uk) have produced a 'List of habitats and species of principal importance for the conservation of biological diversity in England'. This list is required by Section 41 of the Natural Environment & Rural Communities Act 2006.

Table 1 below is a summary of designated and local sites and their legal status. Further information on these sites is to be found in Section 5 of this document. Sites through which RoW are routed are not included in the table.

Table 1: Designated Sites

Designation Type	Number in the County	Number On or Next to a Highway	Legal Status (if any)
Special Area of Conservation (SAC)	8	6	HAR
Special Protection Area (SPA)	2	2	HAR
Ramsar	2	2	HAR
National Nature Reserve (NNR)	11	7	WCA/CRoW*
Site of Special Scientific Interest (SSSI)	126	91	WCA/CRoW
Local Nature Reserve (LNR)	40	-	NPAC
Local Wildlife Site (LWS)	2101	**	-
Special Road Verges	42	42	-

CRoW = Countryside & Rights of Way Act 2000;
HAR = Habitats Regulations 1994;
NPAC = National Parks and Access to the Countryside Act 1949.

* Apart from Ham Wall and Huntspill River NNRs.

** There are sixteen County Wildlife Sites (CWS) that are located entirely within highway limits.

Further information on the legal background to designated sites (SAC; SPA; Ramsar; and SSSI) is given in Section 2 and details of working procedures within or adjacent to these sites are set out in Section 5.

Local Wildlife Sites (LWS), formerly County Wildlife Sites, are locally to nationally important sites for biodiversity and are identified by the Somerset Environmental Records Centre (SERC) according to criteria agreed by its Local Wildlife Sites Group, which is composed of representatives from local authorities, Somerset Wildlife Trust and the Farming and Wildlife Advisory Group.

Local Geological Sites (LGS), formerly County Geological Sites, are locally important geological sites that have been identified by SERC. LGS have also been designated Regionally Important Geological and Geomorphological Sites (RIGS).

Special Road Verges are identified by SCC and / or SERC and are a representative selection of sites next to highways that are of biodiversity interest, usually containing wild flowers which are legally protected or then of biological or cultural importance.

Local Nature Reserves (LNRs), such as Chard Reservoir or Street Heath, are designated by local authorities with the aim of allowing people to see, learn about and enjoy wildlife. They may sometimes also be SSSIs or Local Wildlife Sites. Details are available on the Natural England website - http://www.english-nature.org.uk/special/lmr/lmr_results.asp?C=35

1.4 What this Manual Covers

What is included?

Highways maintenance of county roads and maintenance of Rights of Way (RoW) are included. Forward Transport Plan (FTP) capital infrastructure schemes, RoW Improvement Plan schemes and major improvement works are also included.

What is excluded?

Maintenance and new works that are entirely associated with motorway and trunk road routes (the M5, A303 and the A36) are excluded, as these are the responsibility of the Highways Agency. Maintenance works on roads that are solely the responsibility of District Councils are excluded. The Highways Agency has produced a corporate Biodiversity Action Plan, which is a useful additional reference guide for Somerset. The Highways Agency BAP covers maintenance of trunk roads under its management.

2 Legislation & Policy

2.1 The Conservation of Habitats and Species Regulations, 2010

Designated Sites

If a proposal potentially has a 'significant adverse effect' on an International or European site (i.e. Ramsar, Special Area of Protection (SPA) and/or Special Area of Conservation (SAC) then the Habitats Regulations require a 'test of likely significant effect' be carried out. As the 'competent authority' under the Regulations Somerset County Council must carry out the test.

If the conclusion of the 'test of likely significant effect' is that, if implemented, the proposal is likely to cause a significant adverse effect to the European site's 'integrity' then the authority is NOT permitted by law to proceed with the proposed project.

Significant adverse effect is usually judged according to the likely impact of the proposal (either alone or in combination with other projects) on those features that have led to SAC/SPA designation and in the light of whether the proposal advances or hinders the conservation objectives set by Natural England for the European site.

European Protected Species

For European Protected Species (EPS), such as the dormouse, great crested newt, otter and all bats, listed on Schedule 2, of the Regulations are protected from intentional or reckless disturbance to individuals through inclusion in Schedule 5 of the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way (CROW) Act, 2000), and under the Conservation of Habitats and Species Regulations 2010 it is an offence to:

- deliberately capture, injure or kill any EPS,
- deliberately disturb any EPS in such a way as to be likely to:

- a) impair their ability—
 - (i) to survive, to breed or reproduce, or to rear or nurture their young; or
 - (ii) in the case of animals of a hibernating or migratory species, to hibernate or migrate; or
- (b) affect significantly the local distribution or abundance of the species to which they belong
- damage or destroy a breeding site or resting place.

Note that under the Habitats Regulations 'deliberate' may be interpreted as being aware of / turning a blind eye to a likelihood of something happening and going ahead anyway, i.e. the risk of otter mortality if provision is not made. Therefore, careful consideration, and advice sought from a SCC ecologist with regard to the requirement for otter ledges in schemes.

Special procedures apply when considering highways proposals or planning applications that may adversely affect these species. The system involves an evaluation procedure and a licensing regime that is operated by Natural England. Early consideration of EPS issues is strongly recommended in planning highway works. Refer to Section 6 for taking account of protected species. Penalties for non-compliance with the Regulations can include a fine of up to £5000 per offence, a prison sentence of up to 6 months, and confiscation of vehicles. Either the individual and/or the company may be held liable.

Therefore those carrying out activities that may affect EPS will have to give careful consideration to their presence and also their breeding sites and resting places. With this knowledge in planning highways works the engineer may choose an option that avoids affecting the EPS, if that is possible. Otherwise, Somerset County Council may have to apply for a licence to carry out an activity that would otherwise now be unlawful. Potentially this may cause delays.

Regulation 9(5) of the 2010 Regulations requires all public bodies to have regard to the requirements of the European Habitats Directive when carrying out their functions. Somerset County Council must be satisfied that each of the three tests for EPS is met:

- The development is of over-riding public interest;
- There are no satisfactory alternatives; and
- That the development will have no detrimental effect on wild populations of the species concerned (i.e. favourable conservation status).

It is Somerset County Council's responsibility to ensure that the 'favourable conservation status' of EPS is maintained, aside from any licensing requirement. 'favourable conservation status' (FCS), which is defined as when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and

- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

2.2 Wildlife and Countryside Act, 1981

This Act is concerned with the treatment and management of protected species listed under Schedule 1 (birds), 5 (mammals, reptiles, fish and invertebrates) and 8 (plants). The Act also provides protection for all nesting birds. It is an offence to harm a scheduled species and/or its shelter, but for exact provisions that apply consult the Act or contact either the County's ecologists.

Penalties for non-compliance with the Act can include a fine of up to £5000 per offence, a prison sentence of up to 6 months, and confiscation of vehicles. Either the individual and/or the company may be held liable. Refer to Section 6 for taking account of protected species.

The Wildlife and Countryside Act makes it an offence to plant or cause alien species to grow in the wild. Japanese Knotweed and Giant Hogweed are listed.

With regard to biodiversity local authorities are also required to:

- Make provision for safeguarding SSSIs through powers enabling diversion or closures of rights of way;
- Raise awareness of protected species; and
- Have regard to biodiversity conservation and maintain lists of species and habitats for which conservation steps should be taken or promoted.

This SHBM will form part of the authority's duties with regard to the latter two points.

2.3 Countryside and Rights of Way Act, 2000

Under the Countryside and Rights of Way (CRoW) Act public bodies are obliged to consult Natural England if they or their agents or contractors are undertaking work that may damage a Site of Special Scientific Interest's (SSSI) wildlife or geology. This applies whether the work is being carried out on the SSSI itself or on any other land in such a way that it would affect the SSSI. It is an offence for a public body to carry out, without reasonable excuse, an operation that damages an SSSI without giving adequate notice to Natural England. When going ahead, it is also an offence if they fail to minimise the damage and restore the site as far as practicable. Public bodies can be prosecuted for damaging an SSSI if they fail to follow correct procedures or if they fail to notify Natural England before carrying out or authorising potentially damaging works. This would include highway works. Section 5 details those procedures for works within or adjacent to SSSIs that are likely to be damaging.

Schedule 12 of the CRoW Act adds the provision '**or recklessly**' to 'intentionally' to harming protected species under Section 1 of the Wildlife and Countryside Act 1981 (See Section 2.2).

2.4 Natural Environment and Rural Communities Act 2006

Section 40 of the NERC Act also places a duty on local authorities to have regard to the purpose of conserving and enhancing biodiversity in carrying out its functions.

Section 41 of the Natural Environment and Rural Communities Act 2006 (NERC) Act lists species and habitats of principal importance for the conservation of biodiversity in England (all of which have UK Biodiversity Action Plans) and gives a duty to further the conservation of those listed. Species of conservation importance in Somerset can be found on the Somerset Environmental Records Centre web site <http://www.somerc.com/downloads/> under Somerset Priority Species List. In considering species and habitats when implementing work procedures given in Sections 6 and 7 must be followed and mitigation and enhancement measures given in Section 8 considered.

2.5 Hedgerow Regulations, 1997

The District Councils are normally charged with the duty of implementing these regulations. The Hedgerow Regulations provide protection for hedgerows from removal, which qualify as 'important' based on criteria that include historical and/or species richness and value to wildlife. In determining a removal application, the Regulations require that the Planning Authority serve a Hedgerow Retention Notice on qualifying hedgerows. Only in '*exceptional circumstance*' such as '*in the wider public interest*', is the removal of an important hedgerow permitted. The onus is thus on the applicant to demonstrate the need for removal. Hedgerow removal can be dealt with outside the Hedgerow Regulations if it is part of a planning application but the standards set out in the Hedgerow Regulations must apply.

2.6 Protection of Badgers Act, 1992

The Protection of Badgers Act, 1992, affords badgers legal protection. It is a criminal offence to:

- Wilfully kill, injure or take or attempt to kill, injure or take a badger;
- Damage a Badger sett or part of a sett;
- Intentionally or recklessly destroy a Badger sett (whether a badger is in occupation or not);
- Intentionally or recklessly obstruct access or any entrance to a Badger sett;
- and
- Intentionally or recklessly disturb a Badger whilst occupying a sett.

A licence is required for any work affecting badgers and/or Badger setts. For work to repair damaged highways or RoW the licence is obtained from Defra and for new works from Natural England. Work carried out without a licence is illegal unless it can be shown that the action was the incidental result of a lawful operation and could not have been reasonably avoided (see Table 4 and Section 6).

2.7 Weeds Act, 1959

The Weeds Act, 1959 is concerned with the control of so-called injurious weeds and preventing them spreading onto adjacent land. The five injurious weeds covered by the Weeds Act are:

- Spear Thistle (*Cirsium vulgare*)
- Creeping or Field Thistle (*Cirsium arvense*)
- Curled Dock (*Rumex crispus*)
- Broad-leaved Dock (*Rumex obtusifolius*)
- Common Ragwort (*Senecio jacobaea*)

Primary responsibility for the control of these weeds rests with the occupier of the land on which the plants are growing, including road verges. The Ragwort Control Act 2003 gave Defra's 'Code of Practice on how to prevent the spread of Ragwort' evidential status under the Weeds Act 1959.

Guidance on the control of injurious and non-native plants is to be found in Sections 6.20 and 6.21 and from the County's ecologists or Defra.

2.8 Wild Mammals (Protection) Act, 1996

The Act makes it illegal to cruelly treat any wild mammal including by crushing, asphyxiating or drowning. This would include rabbits, squirrels and hedgehogs. Therefore it is essential that measures be taken to ensure that highway works or maintenance operations will not harm any wild mammal at all.

2.9 Town and Country Planning (Trees) Regulations, 1999

The Town and Country Planning Act, 1990 places a duty on local planning authorities to make adequate provision for trees and to protect existing trees under a Tree Preservation Order (TPO). New trees may also be covered by a TPO. Trees cannot be cut, lopped, uprooted or destroyed whilst protected by a TPO unless it is dangerous or the local planning authority has given consent. District councils keep lists of TPOs.

The regulations also included provision to allow local authorities to protect a tree, group of trees or woodland by placing a TPO on them.

2.10 Salmon and Freshwater Fisheries Act, 1975

The Act makes it illegal to poison or injure fish, their spawn, spawning grounds and the food of such fish. This is important for maintenance operations to bridges or roads adjacent to watercourse where care should be taken that materials do not enter the water. Works involving translocation of fish, due to creation of a diversion channel for example, may require a licence and should be checked with the Environment Agency.

3 Effects of Road Works on Biodiversity

Any works on the roads can have an effect biodiversity either directly or indirectly. The following describes the known effects, although they are not all relevant to all types of work. Recognition of these effects enables positive measures to be taken to mitigate and/or enhance the situation.

Where new developments are to be constructed within or adjacent to existing highway land, Highways Development Control should ideally note whether they have potential for adverse or beneficial biodiversity impacts. This may be caused by the highway works, such as the removal of hedgerows and trees or new habitat creation. If there are concerns these should be passed on to a SCC ecologist who will contact the District or Borough Council and the District or Borough Ecologist (if employed) to see if they are valid observations.

Managing grass and vegetation adjacent to roads can obviously have an impact on biodiversity and a frequent reason for doing this is safety. Any vegetative growth that affects the passage of vehicles, equestrians and pedestrians, or obstructs sightlines to traffic signs and the effectiveness of street lighting can significantly compromise road safety. Maintenance of grass and vegetation is particularly important to secure or improve visibility swathes at junctions and bends.

The following items describe the known effects of highways and their management on biodiversity. These are mainly concerned with roads and are often much less significant with PRoWs. Recognition of such effects enables positive measures to be taken to mitigate and/or enhance biodiversity.

3.1 Disturbance

Changes in patterns of human activity and associated disturbance or damage can disturb species and effect ecosystems. The presence of vehicles and/or humans, such as operatives, can cause visual disturbance to some species, for example to wading birds (Treweek, 1999; Evink, 2002; Seiler, 2002). Where there is an open aspect, such as on the Somerset Levels and Moors human activity may cause disturbance affecting behaviour of sensitive birds. For example, shorebirds can be disturbed at distances of 400 metres by the presence of humans. (Goss-Custard, 2005).

Another example is otters. Anecdotal evidence suggests that otters are not seriously affected by disturbance from anglers, walkers and dogs. Otters do not appear to avoid houses, industry, roads and campsites Although individual otters do not appear to be influenced by short periods of disturbance there is a lack of information on how sustained levels of disturbance influences female otters with young. (McCafferty, n/d)

Traffic noise has been shown to affect the behaviour of species, e.g. bird densities decline where noise is over 50 dbA. Dutch and Swedish research (Reijnen et al, 1995; Helldin & Seiler, 2003) into breeding bird populations has shown an increased shift away from roads according to the amount and speed of traffic.

3.2 Street Lighting

Street lighting is known to effect wildlife by altering nocturnal conditions. Street lighting can disturb the diurnal rhythm of species. Many of the species, including otters and bats are sensitive to artificial lighting. Indeed, the introduction of street lighting can have significant effects on their behaviour, cause loss of access to feeding areas and resting areas, and hence affect the viability of populations. (Outen, 2002; Stone, 2009).

3.3 Habitat Loss

Habitat loss is a major threat to species. In some cases it is directly linked to mortality, and in other cases survival depends on the ability of displaced species to locate alternative habitat. Species require minimum habitat to maintain their populations and it is difficult to assess the impacts of any single scheme. Size of habitat left after loss is also important for species diversity, as there is a threshold for many species that makes smaller patches unviable. The spatial placement of habitat is also important (Treweek, 1999; Evink, 2002; Seiler, 2002).

3.4 Habitat Fragmentation

A key issue in a fragmented landscape is the ability of species populations to survive in and move between small isolated habitat patches scattered within an urban and agricultural landscape. Research has shown that habitat size and wildlife corridors are of vital importance to nature conservation, and to a thriving and diverse wildlife (Natural England, 1996; Dufek, 2001; Evink, 2002). The value of a large area of semi natural habitat outweighs its division into smaller areas where alterations, for example to light, hydrology and levels of disturbance can have a radical effect on species survival. Fragmentation into smaller areas can lead to extinction of predators, larger species and habitat specialists as well effecting pollination in flora – for example Bluebells produce less seed in smaller areas. Road construction and widening would increase fragmentation effects (Treweek, 1999; Evink, 2002; Seiler, 2002).

3.5 Barrier

Wild flowers, invertebrates, amphibians, reptiles and small mammals will be affected by the presence of a road. Those species, which are unable or reluctant to cross roads, will become isolated and hence lose genetic diversity. This isolation could also lead to in the long term the local extinction of some species, which in turn may affect others up the food chain. The creation of barriers or other obstacles affecting the movement of animals may be caused by cumulative development, be it roads and/or housing, within a species range. Road casualties are a significant cause of fauna mortality. In Somerset, Otters are increasingly becoming victims of vehicle collision. Road mortality continues for decades after construction (Treweek, 1999; Evink, 2002; Seiler, 2002) and numbers of casualties counted are often underestimated (Slater, 2002).

Special attention to verge maintenance should be given at locations where wildlife could be expected and endanger road users. For example, deer can be

seen at certain times of the year and on known rutting routes, and clearing a larger depth of verge at these locations can give road users a visibility advantage. A review of deer and collisions is given by Langbein & Putman (2006).

3.6 Pollution

Pollution from road traffic includes air pollution, noise, road run-off, nitrogen deposition, increased levels of lead, de-icing material and dust. Road development may cause changes in air quality, water quality, noise, vibration, light emissions, dust deposition as a result of construction and operation (Treweek, 1999; Byron, 2000; Seiler, 2002).

The effects of diffuse air pollution on wild flowers can be experienced up to 200 metres away from motorways (Bignal, Ashmore & Power, 2004). Examples are traffic noise, which has been shown to affect the behaviour of species, e.g. bird densities decline where noise is over 50 dbA. Dutch and Swedish research (Reijnen et al, 1995; Helldin & Seiler, 2003) into breeding bird populations has shown an increased shift away from roads according to the amount and speed of traffic.

Artificial lighting can affect the growth of plants; disturb the foraging behaviour and breeding behaviour of birds and the behaviour of nocturnal species such as bats and moths. Street lighting can cause a barrier to some species, such as horseshoe bats, causing fragmentation and making roosts untenable (Natural England, 1996; Byron, 2000).

3.7 Hydrological changes

Surface water run-off from development can result in increased flows and/or pollution and result in changed conditions in water environments. The amount of new road surface may significantly affect local hydrology. The amount and quality of water available determines which flora and invertebrates can survive and indeed the type of habitat (Treweek, 1999; Evink, 2002).

3.8 Soil changes

Materials used in construction, road spray, vehicle emissions, dust, and other particulates including that which can be deposited on the land or by precipitation can change soil pH and structure which in turn effects which plants can grow, those invertebrates that can survive and so on up the food chain (Treweek, 1999; Seiler, 2002).

3.9 Changes in numbers of predators and/or prey

Direct loss or change of habitat due to road building will affect the numbers and types of prey available. The increased numbers and speed of road traffic will affect airborne invertebrate and small bird populations. Small mammals may eventually increase in the road verge but this would then attract predators, such as Barn Owls, resulting in increased death to these species from traffic collisions (Treweek, 1999; Ramsden, 2004).

Street lamps can also have an effect on prey availability to bats (Outen, 2002; pers. comm. Emma Stone, University of Bristol). Whereas they do not sustain insect populations *per se* but attract insects from the surrounding natural environment. Therefore, as a consequence of attracting the insects deplete prey availability for light sensitive bats in surrounding zones.

3.10 Introduction of new habitats

As a result of road building, new habitats may be introduced as part of the landscaping the verges and adjacent landform to the scheme. This may include inappropriate non-native species or an imbalance of local species, which in turn may affect the surrounding ecosystem. Roads are also known to disperse seed from 'foreign' sources (Treweek, 1999; White & Ernst, 2003).

4 General Issues Arising from Highways Maintenance Operations

This SHBM aims to make a positive contribution to conserving wildlife associated with the county highways. Unfortunately, highways maintenance can have adverse effects on biodiversity but with care most of these can be managed and mitigated. Threats to biodiversity connected with highways maintenance can include:

- Lack of time allowed for adequate biodiversity surveys in planning works;
- Failure to identify significant constraints such as protected species, SSSIs and LWSs;
- Poor timing of works leading to harm to species, e.g. scrub removal during bird nesting period and mowing grassland before rare flowers set seed in late summer;
- Use of kerbing and badly designed drainage openings can sometimes trap and kill significant numbers of small mammals, reptiles and amphibians in certain locations;
- Physical damage caused by the movement and storage of vehicles, plant and materials;
- Use of insensitive management techniques, e.g. annual over flailing of hedgerows and severe pollarding and root pruning of urban trees;
- Lack of management leading to the deterioration and loss of open habitats. Absence of mowing can lead to the dominance of coarse grasses and eventual colonisation by scrub. To maintain the value of the extended area of highway land beyond the normal cut swathe it may be desirable in certain situations to carry out a full width cut, e.g. to control

scrub on grassland sites. Non removal of cut material may also lead to deterioration of grassland habitats;

- Lack of control of injurious weeds and non-native plants that can push out other more desirable species; and
- Inappropriate soil types used in verge makeup.

Highways maintenance can also have positive effects for biodiversity. Sometimes there are opportunities to create, manage and enhance important wildlife resources within the highway network (see Section 8).

5 Planning Work to Take Account of Biodiversity

5.1 Establishing Known Constraints and Likely Impacts on Biodiversity

This section gives guidance to the planning of all highways and RoW works so that biodiversity is taken into account. Maintaining the safe use of highways for users should always be the first concern and takes priority over biodiversity considerations. However the aims are to, as far as possible, conserve or enhance biodiversity that is present on or next to highway land or RoW.

Highways work may have the potential to directly or indirectly affect valued biodiversity and the checking of ecological constraints is a vital first consideration before implementing highways works. Dealing with wildlife matters at a late stage is not recommended when agreed work schedules and methods will be more difficult to change.

Before any work commences on site make sure that:

- ***Any necessary ecological surveys, assessments and consultations have been completed and taken account of; and***
- ***All highways personnel are aware of any sensitive areas, habitats and species and the measures that are being adopted to protect or enhance them.***

Early preparation of highway work programmes, plans and projects reduces the risk of unnecessary delays that can be costly and also allows more opportunities for taking biodiversity into account to emerge. Note that in preparing a scheme enough time should be allowed for surveys to be carried out at the right time of year (See **Table 4** below)

A sequential approach to biodiversity impacts should be taken in planning and designing schemes. The first priority should be given to avoidance, followed by mitigation, with compensation as the last resort where not all impacts can be mitigated. As good practice and consistent with the statutory biodiversity duty of public bodies biodiversity enhancements or benefits should be sought where possible. Ecological Impact Assessment (EclA) should follow guidelines published by the Institute of Ecologists and Environmental Management (IEEM, 2006).

The County Council's Highways Schemes Proposals Register (HSPR), the Species Alert Mapping, and the County Council's ecologists can assist in searches for records of important sites, species and habitats in a given area.

The following steps should be carried out for each project.

Step 1 – Consult the Highways Schemes Proposals Register (HSPR)

The Somerset Highway Scheme Proposal Register (HSPR) is a register of proposed highways works in Somerset and consists of an integrated database and GIS mapping of schemes. Somerset's HSPR won a 'Green Apple' award for environmental best practice in 2004.

The GIS mapping contains layers of environmental information that need to be taken into account when planning works. The relevant biodiversity layers currently include:

- Ancient Woodland
- Badger Setts within highway land
- Species Alert Mapping
- Special Protection Areas
- Special Areas of Conservation
- RAMSAR Sites
- Sites of Special Scientific Interest
- National Nature Reserves
- Local Wildlife Sites
- Local Geological Sites
- Special Road Verges
- Alien Flora Species

Any occurrences of the above should be noted on the project's checklist and will need responses to ensure that no harm would come to the feature from the proposed works. Further consultation with a SCC ecologist will be required either to determine whether a scheme will have any effect on the species and the course of action needed to ensure that there would be no adverse effects and that the scheme is carried out within the legislation (see **Step 4**).

For an outline of legal requirements for schemes which potentially effect designated sites see **Section 5.2**.

Step 2 – Consult the Species Alert Mapping

In addition to the HSPR a check should be made of the Somerset Species Alert Mapping which is available on **M:\MapInfo\GroupData\Species Alert Mapping**. If there is difficulty in accessing the data or for advice contact the Ecologist – Policy Planning (Ext. 8118).

The Species Alert Mapping is a GIS mapping tool, developed by Somerset County Council in partnership with Somerset Environmental Records Centre. It shows the potential distribution and ranges of important animal species across the County, allowing them to be taken into account when planning works. It is a useful tool for ecological impact assessment.

The Species Alert Mapping can also be used to identify where the road network is acting as a potential cause of habitat fragmentation, which is preventing the movement of species resulting in isolating populations. Once analysed it will highlight locations where measures incorporated into routine works can help relieve the current situation.

Any occurrences of the above should be noted on the project's checklist and will need responses to ensure that no harm would come to the feature from the proposed works.

When a species has been identified using the Species Alert Mapping further consultation with a SCC ecologist will be required either to determine whether a scheme will have any effect on the species and the course of action needed to ensure that there would be no adverse effects and that the scheme is carried out within the legislation (see **Step 4**).

Step 3 – Consult Checklists

In addition to the checks carried out in Steps 1 and 2 it is necessary to assess whether there are potential impacts on biodiversity features not yet identified, such as UK BAP habitats. The above checks are also not definitive as species may occur where no previous record has been made. To establish what valued biodiversity might be present in and around the work site or project area two useful checklists in **Tables 3 and 4** following in Sections 6.3 and 6.4 respectively.

Section 5.3 gives an outline of what sensitivities highways schemes may potentially affect for different types of habitats, including BAP habitats, and species they may support see.

Table 3 in **Section 5.4** gives an outline of how highways schemes may potentially affect protected and other species. **Section 7** gives details of what is required in terms of design, working methods and licensing need to carry out the planned works.

Section 6 gives general guidance on working methods which are aimed at protecting and enhancing biodiversity.

Step 4 - Screening of Results

Once the results of Steps 1 to 3 have been collated they should be submitted to a SCC ecologist for screening.

The screening will assess what course of action is required. This can be either:

- advice on how to proceed with the scheme, including timing and use of measures that eliminates or minimises risk of harm; or
- the determination for further survey work.

If deemed necessary a SCC ecologist will apply to Somerset Environmental Records Centre for species data in the area of the project to further inform the assessment at this stage. Time must be allowed for receipt of this data.

If further survey is required this may be undertaken by Somerset Ecology Services (the County's in house ecology consultancy)

Step 5 – Surveys (if required)

The checking and gathering of biodiversity information is a vital preliminary consideration before implementing schemes and works. Relevant staff must be able to access or request biodiversity information appropriate to the planning of all highways works. Surveys may be required to ascertain the biodiversity value of areas likely to be affected by the scheme or works. It is essential that these be carried out early in the process. Some surveys also require licences, such as for bats or dormouse, and time is needed to obtain them in some cases.

Surveys are best conducted at the appropriate time of year and therefore early notification of any works that might affect biodiversity is absolutely necessary if delays are to be avoided. Some sites may require a number of surveys at different times of year. Additional specialist surveys may then be subsequently required.

All major schemes will require an ecological survey and procedure should follow guidelines published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2006)¹.

Table 2 details the timing of surveys for species and habitats, which should be taken into account when planning work programmes. It should be noted that Highways schemes would not require all of the following surveys but only those that are relevant to that scheme. It should also be noted that some species may require a licence to survey.

Table 2: Survey Timetable

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Aquatic habitats	No survey				Survey possible				No survey			
Aquatic invertebrates	Survey possible				Best time for surveys				Survey possible			
Badger	All year but best time is in April and October / November											
Bats (Roosts)	Inspection of roost sites (trees before leaves appear)				Inspection of roost sites (trees difficult), activity surveys and emergence counts (for foraging routes and feeding activity)				Inspection of roost sites (trees after leaves have dropped)			
Bats (Commuting / Foraging)	No survey			Survey possible								No survey

¹ <http://www.ieem.net/ecia/EclA%20Approved%207%20July%2006.pdf>

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Birds (Breeding)	No survey		Survey possible						No survey			
Birds (Wintering)	Survey possible		No survey						Survey possible			
Common Dormouse	Nut and nest searches.		Nest searches. Least suitable time		Trap surveys/nest tubes till mid-October. Nut and nest searches from September		Nut and nest searches.					
Great Crested Newts	No surveys - hibernating		Adults - Pond surveys mid-March to mid-June but must include visit between mid-April to mid-May Egg – surveys April to mid-June Larvae - surveys from mid-May Terrestrial survey		Larvae surveys to mid-August Terrestrial survey		Terrestrial surveys		No surveys - hibernating			
Habitats/ Vegetation	Mosses and lichens only. Least suitable time			Higher plants and ferns. Mosses and lichens in April, May and September only.			Mosses and lichens only. Least suitable time					
Terrestrial invertebrates	No surveys		Survey possible		Best time for surveys		Survey possible		No surveys			
Otter	All year											
Reptiles	No surveys - hibernating			Activity surveys from April to June and in September and possibly October. Limited by high temperatures during July and August				No surveys - hibernating				
Water Vole	Little activity		All survey methods possible – best time March to June						Initial surveys possible		Little activity	
White-clawed Crayfish	Little activity		Survey possible		No surveys as females releasing young		Best time for surveys		Little activity			

Any data from survey results will be submitted to Somerset Environmental Records Centre.

Following surveys an assessment will be made of impacts on species and habitat potentially affected by the works. In some cases, where designated sites are effected an assessment will be need to be submitted to Natural England for approval. These measures are set out in **Section 5.2** below. An assessment may also require a

licence from Natural England to be applied for where there are potential impacts on protected species. Time will need to be allowed in programming works to take account of these requirements.

Step 6 – Are Enhancement Measures Possible?

Enhancement works also includes schemes to relieve existing problem sites for wildlife in the highway network. For example ‘hotspots’ for species mortality may be alleviated by incorporating mitigation measures in maintenance schemes where appropriate.

Opportunities for enhancement works for biodiversity may be identified early in planning highway activities. Enhancement works include actions to relieve existing problematic sites for wildlife in the highway network, e.g. otter death from crossing roads in times of flood when culverts are unusable. **Section 8** includes detail of measures that would benefit biodiversity both within and outside of the County’s highways land. A SCC ecologist may advise and can be consulted.

Step 7 – Incorporation of Results into the Scheme

As a result of survey and subsequent assessment mitigation measures should be incorporated into the working method for the scheme. Advice on how these could be implemented can be sought from a SCC ecologist. This will include any requirements resulting from licensing (see **Section 7**) and activity effecting designated sites (See **5.2** following).

Assessments may also identify where enhancement to biodiversity is possible. Enhancement works are measures that result in an improvement in the current environment for wildlife on a scheme. Opportunities for enhancement works may be identified earlier in planning highways schemes. This should be considered as a matter of course, in line with the County’s biodiversity duty under the NERC Act 2006 for each scheme. Advice can be sought from a SCC ecologist.

5.2 Requirements for Works Affecting Designated Sites

As noted in the previous section works affecting designated sites are likely to require additional assessment procedures that are submitted to Natural England for approval.

Special Areas of Conservation, Special Protection Areas and Ramsar sites

Special Areas of Conservation (SAC) are designated under the ‘Habitats Directive’. They protect important European habitats and species. Special Protection Areas (SPA) and are designated under the ‘Birds Directive’. They protect areas of importance for rare and declining European birds. Ramsar sites are internationally important wetland sites, important for birds and invertebrates, and are designated under the Ramsar Convention 1971. All these international sites are protected in UK law by the ‘Habitats Regulations’ 2010 (see Section 2.1 above).

If work is within or likely to affect an international or European site advice may need to be sought from Natural England at a very early stage in the planning of highways and RoW maintenance or new works. **A ‘test of likely significant effect’ will be**

required for work carried out within or for area outside the designated site affecting SACs, SPAs or Ramsar under Regulation 61 of the 'Habitats Regulations' 2010.

A precautionary approach to work affecting these sites is required and it is the responsibility of the authority to prove that works will not affect a designated site. This includes off site work – for example, removal of 10 metres of hedgerow can threaten the viability of lesser horseshoe bat roosts (which may be cited under a SAC designation) and would require a 'test of likely significant effect' to be made on the scheme. Horseshoe bats can feed more than 4 kilometres from their roost site.

An ecological survey and appraisal by a SCC ecologist and/or an ecological consultant may be required.

It should be remembered that all international sites are also SSSIs and for such sites in some cases the arrangements set out below for SSSIs may be sufficient. **Please consult a SCC ecologist for further advice on works affecting a SAC, SPA and Ramsar site.**

Sites of Special Scientific Interest

Sites of Special Scientific Interest (SSSI) are designated by Natural England for their nationally important biological or geological significance. Around half of the SSSIs in Somerset are designated for their geology. They form a nationally important conservation system and are protected by the Wildlife and Countryside Act 1981 and the Countryside & Rights of Way Act 2000 (see Section 2.2).

Early preparation of highway or RoW work programmes for operations in or near to SSSIs is essential. This is because **any highway or RoW works within or adjacent to an SSSI will require a notice letter for operations to be sent to Natural England before any work can take place on site** (see Appendix 1). A separate notice for each scheme will be sent through a SCC ecologist. Larger works may require an ecological survey and appraisal. This may also include surveys by specialists. Therefore it essential that works is planned well ahead of implementation.

It is recommended that a schedule of works for the forthcoming year should be prepared and submitted to Natural England in January for comment and advice. This should ease the assent notice consultation requirement.

5.3 Consideration of Other Sites

Local Wildlife Sites

Local (formerly County) Wildlife Sites are locally important sites for biodiversity and are identified by the Somerset Environmental Records Centre (SERC) according to criteria agreed by the Local Wildlife Sites Group. These sites contain habitats and species of County value at least and up to national importance.

Where maintenance work occurs within or adjacent to a Local Wildlife Site the Somerset Wildlife Trust should be consulted on works affecting these sites.

Special Road Verges

Special Road Verges are identified by Somerset County Council ecologists and are a representative selection of sites next to highways that are of biodiversity interest, usually containing wild flowers of importance.

For work in Special Road Verges a SCC ecologist should be consulted. Criteria for Special Road Verges are being developed and the list of sites reviewed and updated over time. This should include the presence of rare plant and invertebrate species and other features of wildlife importance.

Local Geological Sites

Local Geological Sites (LGS) are locally important geological sites that have been identified by the Somerset Geology Group. Where maintenance work occurs within or adjacent to a County Geological Site both the Somerset Wildlife Trust should be contacted. LGS have also been designated Regionally Important Geological and Geomorphological Sites (RIGS).

Exmoor National Park

Exmoor National Park was designated in 1954, under the National Parks and Access to the Countryside Act 1949, for its outstanding landscape with aims including the conservation and enhancement of its natural beauty, wildlife and cultural heritage. One of the main reasons why Exmoor was chosen as a National Park was the beauty and variety of its wild landscape. This landscape includes moorland, woodland, river valleys, known as combes, and coast and cliffs. Each type of landscape provides many different habitats for a large number of animals, birds, insects and plants.

If the work to be undertaken is likely to affect the National Park, then use best practice methods as contained in this SHMB to take account of biodiversity as far as possible so that problems are unlikely to occur. If protected species are present or likely to be present, then for some works you may require an ecological survey and therefore contact a SCC ecologist if assistance is required. The Exmoor National Park Authority ecologists must also be consulted.

Areas of Outstanding Natural Beauty

Areas of Outstanding Natural Beauty (AONBs), such as the Mendip Hills, are designated to conserve and enhance natural beauty that includes biodiversity. All other designations may also fall within AONBs. The Countryside & Rights of Way Act 2000 also confers on Local Authorities a general duty to have regard to the purpose of conserving and enhancing the natural beauty within AONBs (see Section 2.4).

If the work to be undertaken is likely to affect AONB, then use best practice methods as contained in this SHBM to take account of biodiversity as far as possible so that problems are unlikely to occur.

Other Designated Sites

Local Nature Reserves (LNRs), such as Chard Reservoir or Street Heath, are designated by local authorities with the aim of allowing people to see, learn about and enjoy wildlife. They may sometimes also be SSSIs or County Wildlife Sites. Details are available on the Natural England website -

http://www.lnr.naturalengland.org.uk/Special/lnr/lnr_search.asp

If the work is likely to affect these types of site then use best practice methods as contained in this SHBM to take account of biodiversity as far as possible so that problems are unlikely to occur.

5.4 Important Habitats and Features

Looking beyond designated sites the existing or proposed highway corridor is most likely to include one or more of the habitats or features listed in **Table 3**. The table also indicates the potential biodiversity issues that may arise or need to be considered. The habitats may also constitute UK BAP or Somerset Local BAP priority habitats. Identify which habitat is being affected by the works. The Main Sensitivities/Issues (Risks) column gives an outline of which issues may occur as a result of carrying out the works.

Table 3: Habitat Sensitivities

Highway Land Habitats & Features	Main Sensitivities/Issues (Risks)
Woodland, Scrub, Hedgerows & Trees	<p>Ancient / BAP woodland habitat</p> <p>Nesting Birds</p> <p>Roosting Bats</p> <p>Loss, fragmentation or degradation of bat flight lines (hedgerows, scrub, lines of trees)</p> <p>Dormouse</p> <p>Badger setts & foraging habitat</p> <p>Otter holts & resting places (if near watercourses)</p> <p>Veteran Trees (important in own right and support beetles, flies, fungi, lichens, etc.)</p> <p>Woodland flora (esp. bluebells, wood anemone etc.)</p> <p>Feeding/roosting wintering birds (e.g. redwing and fieldfare)</p> <p>Dead wood invertebrates</p>
Grassland & grass verges/embankments/ cuttings	<p>Unimproved/species-rich grassland (BAP habitat)</p> <p>Rare, diverse & valued flora (esp. perfoliate pennycress, orchids, cowslips etc.)</p> <p>Hunting area for barn owl, kestrel & other predators</p> <p>Small mammal habitat</p> <p>Badger setts & foraging habitat</p> <p>Slow-worm & common lizard habitat</p> <p>Great crested newt habitat if ponds nearby</p> <p>Invasion by injurious weeds (e.g. ragwort)</p>

Highway Land Habitats & Features	Main Sensitivities/Issues (Risks)
	Non-native invasive species (e.g. Japanese knotweed)
Watercourses, Ditches & Ponds, Riparian & Wetland Habitat	<p>Protected and rare wetland wildlife habitat (particularly great crested newt, water vole, crayfish, otter, fish, freshwater mussels / snails)</p> <p>When this habitat is nearby roads can be crossing points for toads</p> <p>Pollution causing death/loss of fish, invertebrates and plants</p> <p>Erosion of habitats from high flow/volume of water running off roads</p> <p>Non-native invasive species (e.g. Himalayan Balsam)</p> <p>Fragmentation of riparian habitat (e.g. to otters)</p> <p>Culverts and pipes can provide barriers to wildlife (e.g. otters)</p> <p>Drying out caused by excessive deepening of roadside ditches</p> <p>Existing & new habitat can alleviate flooding and fit in with road drainage needs</p>
Heathland & Bracken	<p>Heathland is common on Exmoor and in the Quantocks and is also found in the Mendip Hills</p> <p>Scarce heathland wildlife (e.g. nightjar)</p> <p>Adder & common lizard habitat</p> <p>Erosion of habitat from vehicle passing places and widening</p> <p>Next to road sites are susceptible to fire</p>
Bridges, Tunnels & other Structures	<p>May support roosting bats</p> <p>May have nesting birds (e.g. grey wagtail, wren) or insects (e.g. bees)</p> <p>Adjacent watercourse wildlife may apply (see Watercourses, Ditches & Ponds, Riparian & Wetland Habitat above)</p> <p>Tunnels can provide routes for wildlife to move through</p>

Highway Land Habitats & Features	Main Sensitivities/Issues (Risks)
	<p>Culverts and pipes can provide barriers to wildlife (e.g. otters)</p> <p>Issues associated with walls & rock faces (below) may also apply</p>
Walls & Rock Faces	<p>May support roosting bats</p> <p>Nesting birds behind vegetation and in crevices</p> <p>Shelter or breeding sites for invertebrates (e.g. snails, bees)</p> <p>Lichen, moss & liverwort habitat</p> <p>Common lizard habitat</p> <p>Note may have a value for geodiversity may be a Regionally Important Geological Site (check with a SCC ecologist)</p>

5.5 Important Species

Consider whether the planned work may have the potential to affect important species this may be the case even if only manmade structures are present. Many works are unlikely to harm important species if the guidance set out in this document is followed. **Table 5** gives some guidance on where work is likely to encounter protected species.

In Somerset there are a number of species protected by both UK and European law. The condition 'reckless' was added to 'intentional' killing, harm or destruction of shelter, for certain species listed in the Wildlife and Countryside Act 1981, e.g. water voles. **There is no defence in law if it could have been reasonably known that these certain species were present and would be likely to be affected by works.**

Table 4 summarises some of the important species that you are likely to encounter in carrying out highway works. However it cannot be comprehensive and knowledge of the distribution of protected species in the county is incomplete. Major schemes are likely to encounter a wider range of species.

If a rare, scarce or a BAP species (see Section 1.4) occurs on or near to the work site then plans and methods should be adopted that avoid long-term harm to the species. Opportunities to further the conservation of the species should be explored. Consult a SCC ecologist for further assistance if such a species is identified on or near the work site. The Somerset Wildlife Trust and Natural England may also be helpful.

Refer to Sections 6 and 7 on what requirements you need to incorporate into a scheme's design, working methodology and for licensing information for each of the species listed below. The procedure column refers to the location within Sections 6 or 7. Section 6 gives more generic working methods and Section 7 is species specific and includes all Boxes.

Table 4: Protected Species Sensitivities and Issues on or Adjacent to Highway Land

	European Protected Species. Protected by the Habitats Regulations
	Nationally Protected Species. Protected by the Wildlife & Countryside Act
	Protected by the Protection of Badgers Act
	BAP Species (UK or Local)

Type of Work Planned	Species Potentially Affected	Issue	Procedure
Grass Cutting	Great crested newt	Death or injury from cutting blades	6.3
	Reptile Species (Adder, grass snake, common lizard, slow worm)	Death or injury from cutting blades	6.3
	Amphibian Species (Common toad, common frog)	Death or injury from cutting blades	6.3
Hedgerow removal or trimming	Common Dormouse	Death, injury, destruction of or damage to nests, disturbance	Box 7
	Bats	Degradation or loss of flight lines affecting population viability	Box 1
	Badger	Death, injury, destruction of or damage to setts, disturbance	7.7
	Breeding Birds	Disturbance at nest or rearing young (Schedule 1 Birds); damage or destruction of nest	Box 17

Type of Work Planned	Species Potentially Affected	Issue	Procedure
	Barn owl	Increased risk of death or injury due to opening up of habitat alongside road	Box 20
	Great crested newt	Death or injury, destruction of resting place if removed	Box 12
Tree removal, pollarding, crown raising, etc	Common Dormouse	Death, injury, destruction of or damage to nests, disturbance	Box 8
	Otter	Destruction of laying up places, disturbance	Box 10
	Bats	Death, injury, destruction of roost sites, disturbance Degredation or loss of flight lines affecting population viability	Box 2
	Badger	Death, injury, destruction of or damage to setts, disturbance	7.7
	Breeding Birds	Disturbance at nest or rearing young (Schedule 1 Birds); damage or destruction of nest	Box 17
	Barn owl	Increased risk of death or injury due to opening up of habitat alongside road	Box 20
Scrub removal	Otter	Destruction of laying up places, disturbance	Box 10
	Common Dormouse	Death, injury, destruction of or	Box 7

Type of Work Planned	Species Potentially Affected	Issue	Procedure
		damage to nests, disturbance	
	Bats	Degradation or loss of flight lines affecting population viability	Box 1
	Badger	Death, injury, destruction of or damage to setts, disturbance	7.7
	Breeding Birds	Disturbance at nest or rearing young (Schedule 1 Birds); damage or destruction of nest	Box 19
	Barn owl	Increased risk of death or injury due to opening up of habitat alongside road	Box 20
	Great crested newt	Death or injury, destruction of resting place	Box 12
	Reptiles	Death or injury	Box 21
Verge excavation - such as trenches for drainage, grips, gullies, soakaways and service tunnels, post holes or foundations for safety structures (also along rights of way) Verge make up and deposition – such as following kerbing, or surfacing works, or following ditch clearance, and other excavation	Badger	Death, injury, destruction of or damage to setts, disturbance	7.7
	Great crested newt	Death or injury, destruction of resting place	Box 13
	Reptile Species (adder, grass snake, common lizard, slow worm)	Death or injury	Box 23

Type of Work Planned	Species Potentially Affected	Issue	Procedure
Storage and use of equipment and materials on verges	Flora Species Perfoliate Pennycress	Destruction of plant (present in road verges around Charlton Mackerell)	6.9
	Flora species Alpine Rock-cress	Destruction of plant (present in road verges around Millards Hill House, Trudoxhill)	6.9
Ditch, Ryhne or Pond Clearance	Badger	Death, injury, destruction of or damage to setts, disturbance	7.7
	Water Vole	Death, injury, destruction of or damage to burrows	Box 16
	Grass Snake	Death or injury	Box 22
	Great Crested Newt	Death or injury, destruction of resting place	Box 14
	Amphibian Species (common toad)	Death or injury	7.11
	Lesser Silver Water Beetle	Death or injury, destruction of resting place	Box 26
	Other aquatic invertebrates	Death or injury, destruction of resting place	Box 26
Pot-hole Repair, Patching and Highway Subsidence	Badger	Death, injury, destruction of or damage to setts, disturbance	7.7

Type of Work Planned	Species Potentially Affected	Issue	Procedure
Kerbing	Great Crested Newt	Death or injury from introduction of obstacle preventing migration	Box 15
	Amphibian Species (common toad)	Death or injury from introduction of obstacle preventing migration	Box 24
Gully Construction	Great crested newt	Death from falling in	Box 15
	Amphibian Species (common toad)	Death from falling in	Box 24
Bridges and Structures (including work in adjacent watercourses)	Bats	Death, injury, destruction of roost sites, disturbance Degredation or loss of flight lines affecting population viability	Boxes 3, 4 and 5
	Otter	Destruction of laying up places, disturbance Alteration to structure may force otters to use roads risking death or injury	Box 11
	Water vole	Death, injury, destruction of or damage to burrows	Box 16
	Badger	Death, injury, destruction of or damage to setts in bridge or other structures, disturbance	7.7

Type of Work Planned	Species Potentially Affected	Issue	Procedure
	Breeding Birds (including kingfisher)	Disturbance at nest or rearing young (Schedule 1 Birds); damage or destruction of nest	Box 18
	Atlantic white-clawed crayfish	Death, injury, Destruction of resting place	Box 25
Street Lighting	Bats	Disturbance of roost sites Degredation or loss of flight lines affecting population viability	Box 6
	Common Dormouse	Disturbance of nest sites, degradation of habitat affecting population viability	Box 9
	Breeding birds	Disturbance of nest sites and rearing young (Schedule 1 species)	Box 19

Where two or more species are affected by works on the same site or by new construction consideration should be given to the rarest in terms of local populations and to the national context when designing mitigation and/or enhancement measures. This does not mean that legal requirements regarding any species should be waived. Advice should be sought from a SCC ecologist.

6 Generic Methods to Take Account of Biodiversity

6.1 General Matters

Highway works need to be planned following the guidance set out in Section 5.1 above. This part of the document is used to inform working methods as necessary. It covers generic matters that relate to the carrying out of specific tasks and in certain situations. The objective is that highway work impacts on biodiversity should be minimised and biodiversity is benefited or enhanced wherever possible. Much of what is said here is common sense and is good practice for the Highways Authority as well as its contractors and partners to follow.

Early preparation of highway and Rights of Way work programmes will allow more opportunities for taking biodiversity into account. Such an approach is likely to be more economical and efficient than dealing with wildlife matters at a later stage when agreed work schedules and methods will be more difficult to change. Delays may result from 'discovered' wildlife constraints after work has been initiated.

In all situations any harm to biodiversity should only occur if it is unavoidable (e.g. due to safety considerations, emergency actions, situations with a proven over-riding public benefit). Harm should be mitigated and lead to reinstatement or compensation and if possible long-term wildlife benefit.

Before any work commences on site make sure that:

- ***Any necessary ecological surveys, assessments and consultations have been completed and taken account of; and***
- ***All highways personnel are aware of any sensitive areas, habitats and species and the measures that are being adopted to protect or enhance them.***

The sections below cover detailed matters that relate to the carrying out of specific operations. The objective is that the negative impacts of highway works on biodiversity are negated or minimised and benefit is gained wherever possible. Much of what is said here is common sense and is to be adopted as good practice by the County Council. It includes material derived from information produced by Gloucestershire County Council, Devon County Council and the Farming and Wildlife Advisory Group.

6.2 Finding Protected Species

Protected species may potentially be found on a site after work has started. If this is the case or presence of a protected species is suspected, then work should be stopped and reported to the superintendent / engineer for the site as quickly as possible. Advice should be sought from a SCC ecologist. Prompt action will minimise delays to work. Continuing to work in the presence or suspected presence of protected species can lead to prosecution, resulting in a fine and even imprisonment (see **Section 2.2**).

6.3 Grass Verges

Historically the management of grassland verges has given rise to their value for wild flowers. Today the biodiversity value of grassland verges is largely based on whether it is cut, left unmanaged or affected by herbicides or fertilisers. The frequency and method of cutting will reflect the species composition and abundance. Removal of cuttings on nutrient-rich sites can have the added benefit of improving or maintaining plant biodiversity. Where cuttings are not removed and the low frequency of cutting allows tall and tussocky growth to occur plant biodiversity will be low but invertebrate biodiversity may be high.

Cuts carried out too early in the growing season can prevent some plants from flowering and/or setting seed. A large number of insects such as beetles, flies and bees depend on flowers for their survival and birds such as linnet and goldfinch make use of the seeds (especially thistles and docks).

Cuts made later in the year (August) encourage annual plants (e.g. grass vetchling, white campion, yellow-wort and autumn gentian) and late flowering perennials (e.g. field scabious, wild carrot and common toadflax). Late summer cuts also give protection to ground nesting birds if they are expected to be present

Frequent cutting, which is often carried out in urban areas or where visibility is a crucial safety issue, is usually of limited value to wildlife. Such treatment kills off many plant species and reduces cover for animals. However, sometimes in certain locations frequent cutting can support a good range of spring flowers and annual species.

Growth retardants may be used at a small number of selected sites where road safety is an issue both for the driver, in terms of visibility, and for roadmen working on high-speed roads, such as along the central reservation of dual carriageways.

It can be difficult to set a precise timing for cutting a verge with a particular biodiversity interest, Special Road Verges for example. This is because of seasonal variations in climate that can affect growth rates and flowering patterns. A flexible period can be defined and cutting targeted within this depending on the amount of vegetative growth or plant height or flowering/seeding patterns recorded. Special Road Verges are mapped on GIS and each site will have details on when to cut.

Infrequent or no cutting benefits bramble, scrub and trees and can support a range of animal species. However, if the grassland is an important one (SSSI, LWS or Special Road Verge), then this should not be the preferred approach.

The main points for implementing highway grassland maintenance are:

1. Meeting between grass cutting contractors and Area Highways officers should take place pre-season. Special Road Verges are clearly marked on a plan and marked on site with signs. Currently their presence is alerted to the operative by means of a GPS system fitted in the cabs of grass cutting tractors;
2. Grass cuttings will normally be left behind on the verge or path. On designated sites where there are real identifiable biodiversity gains to be had, the cuttings may be removed. This removal will generally need to take place earlier than September/October in the interests of reducing the nutrients returned to the soil;
3. Generally the first cut will be carried out in April/May, and a second may follow later in the year, but only if necessary. However, if possible delaying the cut to late May, with **the cutter bar set no lower than 10cm**, will allow small plants to flower and set seed (Natural England, 1999). On certain urban routes and on complex road junctions that require high visibility, then cutting may need to be more frequent. On RoWs in high growth years, a third cut may be necessary in some places.
4. There is an agreement to delay mowing on some Special Road Verges due to their botanical content/ wild flower value. Other special arrangements may be

developed during the life of this SHBM for other Special Road Verges. Consult a SCC ecologist.

5. Width of cut on road verges is up to 1 metre wide in most circumstances, but 2 metre and 3 metre cuts may be necessary on some road verges for the sake of visibility;
6. The remainder of highway grassland should be left unmanaged or mown no more than once a year, usually in late September/October, so as to allow plants to flower and set seed. In some locations, grass cuttings may need to be removed. This may need to take place earlier than September/October in the interests of reducing the nutrients returned to the soil. Other management may be required to benefit a particular species and these verges will be identified;
7. On some paths and carriageway edges a 'no cutting regime' is possible and could be adopted where safety is not an issue. This can be done where a self-sustaining 'meadow' flora has become established but where this needs to be maintained a cut every 3 to 6 years will probably be needed to avoid scrub and tree colonisation; and
8. RoWs will be cut to the width necessary to allow use of the path without encroachment from vegetation, e.g. wet vegetation hanging into the path. These vary depending on widths specified in Definitive Statement and other RoW records. Elsewhere minimum widths are defined in Schedule 12A of the Highways Act 1980 and are as follows: cross field footpath 1 metre; headland footpath 1.5 metres; cross field bridleway 2 metres; and headland bridleway or carriageway (whether cross field or headland) 3 metres.

Grass cutting operators should be aware of the presence of ground nesting birds, particularly when cutting RoW

6.4 Hedgerows

Hedgerows are often important biodiversity features and they can also have landscape and historical value. Hedgerows are habitats in themselves and can also function as wildlife corridors. This section was developed using guidance produced by the Farming and Wildlife Advisory Group.

The County Council owns only a few hedgerows. Hedges usually belong to the adjacent landowner. The Highways Act 1980 (section 154) empowers the County council as Highway Authority to protect the safety of highway users by ensuring that landowners and occupiers carry out their legal duty with respect to roadside trees and hedges. If a hedgerow is causing visibility or access problems on a highway, the landowner will be asked to cut it. If it is not possible to get hedgerows cut in any other way, the County Council may take action.

Similarly, on RoW adjoining hedgerows are the responsibility of the landowner, but the County Council may take action to cut hedgerows that are obstructing stiles or where hedgerow needs to be removed to install new stiles or gates.

Hedgerows need to be managed sensitively to maintain their biodiversity value, but also to maintain their effectiveness as a stock proof barrier.

Roadside verges and hedges cut under contract must not deviate from the specification provided below. The specification is set to maintain good roadside visibility in accordance with safety requirements for pedestrians, cyclists, horse-riders and motorists.

Regular trimming has long been part of 'tidy' farming but annual trimming is usually unnecessary on **non-roadside hedges**. Flailing undertaken responsibly can produce dense and bushy hedges that are thick at the base. Such hedges, especially when associated with grassy verges, are valuable for wildlife and support birds like chaffinch, dunnoek, greenfinch, robin, song thrush, tree sparrow, whitethroat, wren and yellowhammer. For cutting back older, thicker stems consideration should be given to using a circular or other appropriate saw.

Different hedge shrub species respond in different ways to trimming. Continued trimming of hazel, for example, will lead to a weak and gappy hedge that will not be stock-proof or hold much value for wildlife. Other species, like hawthorn and blackthorn can respond well to trimming.

For a practical means of reducing hedge size and rejuvenating the growth of many woody species hedge laying may be a consideration. This is a traditional form of management and can be carried out as infrequently as once every twenty years. This was once a widespread practice although not every hedge was laid. Longer lengths over a few hundred metres are unlikely to be suitable for this treatment unless tackled on a rotational basis over several years.

Some roadside 'hedges' more closely resemble woodland edge, and may never have been managed as a hedge. This type of scrub may be coppiced using an appropriate saw or lopper (i.e. cut down to near ground level and allowed to re-sprout). This is done in winter on a regular cycle of 3 - 10 years. For hedgerow trees see the section that follows.

The main points for implementing highways hedgerow maintenance are:

- **Be Aware Of Those Hedgerows Which Support Dormouse Populations** (See Section 7)
- **To Avoid Disturbing Nesting Birds** Never trim during the bird nesting season as it is an offence to disturb nesting birds.
- **Trim in Late Winter** to leave fruit for birds and mammals throughout the autumn and winter. February is the best time but try to avoid frosty conditions, as wood will splinter. *Cut back/restore hedges in winter (November to February)*. Try to avoid extensive lengths always leave some to cut in a year or so unless there is plenty of similar adjoining habitat on non-highway hedges.
- **Cut A Few Inches Further Out** from the last cut. Cutting back to the same point will remove the new branching points, so new growth will have to come from old wood. When cut repeatedly this way the whole plant may be weakened. Trimming further out with each successive cut will allow the hedge to grow in height and width. This can then be trimmed back on a long rotation;

- **Trim on a 2- 3 Year Rotation** to allow some sections of hedge to flower and set fruit each year. Gappy hedges can be grown tall and restored by laying and coppicing. Grant aid may be available. Continue to trim roadside hedges annually to maintain visibility;
- **Leave Hedge Tops Uncut** for song posts for birds. Continue siding the hedge to prevent it encroaching into field, track or road. If the top of the hedge needs to be trimmed, in locations where there are road signs for example, this should be done in alternate sections on a two-year rotation, usually in January/early February. This will avoid removing sources of food (berries) for wildlife during the winter months. It will also avoid the bird-nesting season;
- **Hedge Profiles** - Shaping the hedge to a profile, rather than 'flat topping' is a good way of developing taller, thicker hedges and it also one of the most beneficial yet simplest ways of helping wildlife.



CHAMFERED



A-SHAPED



ROUND-TOPPED

Trimming at a 30-45° angle has many benefits over the traditional cut – it will let more sunlight penetrate the body of the hedge to stimulate growth, allow saplings to develop and gives more blossom and fruit. There is also less predation of chicks from nests in A-shaped hedges. This is thought to be due to better cover and camouflage. Conversely, nests are highly visible in a flat-topped hedge leading to a greater loss of young birds.

- **Tunnel Structures** - Where hedges have grown up to create a 'tunnel' structure, trimming should not destroy this effect. Tunnels can provide important habitat links for species such as dormice and bats;
- **Hedgerow Trimmings** should not be left on the carriageway or path. They can be a particular hazard for cyclists and sometimes horses and walkers also. Hedgerow trimmings can also damage ground flora if left in thick piles. However, if there are areas where arisings can be piled up to potentially form hibernacula for reptiles, amphibians and other species then the opportunity should be taken. Remove or if there is excessive material to be left on site chip and spread over small areas which have low biodiversity value (around tree/hedge bases especially if in dense shade with little existing vegetation).
- **Hedge Gaps** should be filled in by allowing natural regeneration to occur or by replanting with native species already found in nearby hedgerows. The Arboricultural Officer as well as a SCC ecologist can advise further on the choice of appropriate species. Native species of local provenance (progeny of plants growing close by or as near as possible) should always be used in preference to exotic species, unless there are exceptional circumstances, for example a restoration of long established ornamental hedge or certain urban situations amidst hard landscaping for instance; and

- **The Selection of Species** for new hedgerows will be specified in the ecological report accompanying highway maintenance schemes that include hedgerow removal.

Taller, thicker hedges offer:

1. ***Shelter to stock*** - Reduced wind speed, which can have an effect into the field up to 12 times the hedge height;
2. ***Shelter to crops*** - As above - higher field temperature will lead to an increased soil temperature, particularly important in the spring;
3. ***Greater wildlife value*** - More food sources, nest sites, song posts and protection in a higher, bulkier hedge for birds, small mammals and insects;
4. ***Saplings to develop*** - These can be tagged (to be highly visible to the trimmer) to grow the next generation of hedgerow trees; and
5. ***Savings on trimming bill*** - Less frequent trimming can save money and time even with a greater volume of material to remove.

Where a hedgerow also consists of a large raised (often ancient) bank this should be managed as a hedgerow, grass verge or wall whichever is most appropriate. The general rule is not to manage too harshly, so that no damage occurs to the bank that can have biodiversity but also historical value.

If anything more than maintenance trimming is planned, e.g. thinning the width by more than 40%, setting back the position of a hedge or complete or partial removal, then the Hedgerow Regulations 1997 may apply (see **Section 2.5**). A SCC ecologist will carry out a survey and advise.

6.5 Trees

The County Council owns those trees that have been planted or have established themselves within the highway limit, but otherwise trees usually belong to the adjacent landowner, or the landowner in the case of RoW, so tree management is not often carried out. If a tree is causing visibility or access problems on a highway, the landowner will be asked to undertake appropriate management. Where trees are causing a safety issue and this cannot be dealt with in any other way, the County Council will take action. In an emergency situation (such as after a storm where trees and branches have fallen across main roads) the County Council will normally take immediate action.

Where trees are present on a work site and may be at risk from damage, then establish with the appropriate District Council whether such trees are protected by a Tree Preservation Order (TPO) or are in a Conservation Area (see **Section 2.7**). The District Councils usually consider applications for works to protected trees within 8 weeks. The Office of the Deputy Prime Minister produces guidance at <http://www.urban.odpm.gov.uk/greenspace/trees/tpo/guide/index.htm>.

Large and old trees are often called 'veteran trees' and have biodiversity value for insects and bats. These trees should also be protected. Somerset Environmental Records Centre has mapped 'veteran trees', although this does not show all such trees in Somerset. However, many 'veteran trees' have not yet been recorded along highway routes.

Tree work is best done in the winter during the period **December to February** and this also means that the bird nesting and bat roosting periods are avoided.

Some trees also provide potential roost sites for some bat species. Guidance given for bats in Box 2 in Section 7 needs to be taken into account before any work takes place.

Indirect works such as trenching or cable laying have potential to damage tree roots. Avoid locations with roots or, if this is not possible, employ hand-digging techniques that will minimise unnecessary root loss. A government consultation document '*Roots and Route: Guidance on Highways Works and Trees*' (to be revised) is available on this topic at <http://www.roads.dft.gov.uk/consult/roots/index.htm>. Note that guidance is also available in NJUG10 and BS 5837: 1991 '*Trees in relation to construction*'.

Tree cutting (surgery) may on occasion be necessary. Occasionally on highways overhanging growth will be removed from shrubs or trees adjacent to routes to allow safe access. It is good practice to inform the local Parish Council if a tree has to be felled. All such work is best done in the winter months. Tree surgery on 'veteran trees' should be carried out with the minimal work as necessary and should either be unavoidable for safety reasons or a positive measure to prolong the life of the tree.

The County Arborist should be contacted for advice on any work that may affect trees. Tree surgery methods that can be employed include pruning and pollarding.

'Woodland tunnels' created by overhanging trees should be managed sympathetically, with limited tree pruning carried out for safety and access reasons.

Felling of any tree, dead or alive, should be regarded as a last resort measure. It should only be felled if it is diseased, damaged or constitutes a safety risk. Age itself is not a reason for felling. Always look for other alternatives to felling first. Consideration should be given to retain the tree trunk as a tall 'monolith', which would provide dead wood habitat for a period of years.

How woody material is disposed of depends upon the quantity involved and arrangements may have to be made with the adjoining landowner. Wood is usually stacked and left on the land (creating dead wood habitat piles), or the owner or County Council may remove it. It is more likely that large pieces of wood would be removed from site, but this has to be balanced with the accessibility of the site for removing the wood and associated costs. Large logs are often of more benefit to wildlife so if they can be left in a safe and out of sight place then do so.

When a tree has been felled a replacement of the same species, or an appropriate native species should be considered. These should be sourced locally (See 'Trees' in Section 8 below). Usually the tree should be planted adjacent to the stump of the felled tree unless fungi killed it. If the tree was felled because it was dangerous by virtue of its location, a replacement should be planted at an acceptable nearby location. If the stump is not considered to be dangerous, it should be left *in situ* either to re-grow or provide a niche for dead wood invertebrates and fungi. Stumps may be treated with an approved biodegradable herbicide if it is imperative for safety reasons that the tree should not re-grow. Cutting back re-growth repeatedly over several years can weaken the growth and make the use of herbicides unnecessary.

6.6 Scrub and Saplings

Scrub supports a range of species and is particularly good as a food source (e.g. berries) or shelter. Where roadside scrub needs to be cut back, it should be coppiced on a regular cycle, commonly every three to ten years. Scrub growing within two metres of the carriageway should be cut every three years. Common species include bramble, hazel, hawthorn and blackthorn. The cut stumps should normally be allowed to re-grow, and not be removed or poisoned.

Scrub work is best done in the winter during the period **December to February**, which also means that the bird-nesting season is avoided.

However on PRowS and on wider road verges that are infrequently cut clearance of scrub may sometimes be necessary not just for safety and access reasons but also for biodiversity ones. There is often an equal or greater value to be gained for biodiversity by its careful removal. In suitable highway locations the removal of young trees and shrubs followed by regular and wide swathe cutting can deliver conservation/enhancement of species-rich grassland, heathland or the opening up of standing water bodies.

On RoWs and on wider road verges that are infrequently cut, clearance of scrub may sometimes also be necessary. This may take the form of re-opening a path by cutting away scrub to enable safe passage along a route. Occasionally the work may necessitate the removal of stumps or their treatment with an approved herbicide to prevent re-growth. Cutting back re-growth repeatedly over several years can weaken the growth and make the use of herbicides unnecessary.

How woody material is disposed of, is considered in the section on Trees above.

Sometimes scrub and young tree (sapling) cutting may necessitate the removal of stumps or their treatment with an approved herbicide to prevent re-growth. Cutting back re-growth repeatedly over several years can weaken the growth and make the use of herbicides unnecessary.

6.7 Planting and Sowing

Where it is considered necessary to restore the vegetation on a verge following excavation seeds and plants used in restoration should be suited and native to the location and be of local provenance. If local material cannot be sourced then the nearest suitable native stock may be acceptable. Mixtures should be based on natural plant communities if possible and should come from local and English sources only. A SCC ecologist or County Arborist can advise further on this matter. Flora Locale has a web site that contains some useful guidance material (www.floralocale.org). The publication '*Go Native! Planting for biodiversity*' is particularly relevant.

Avoid importing topsoil but if this cannot be avoided make sure it is of low nutrient status and does not contain injurious weeds or non-native species (see Sections 6.20 and 6.21 below). Topsoil should also be of the same type as the adjoining verge.

Avoid new planting and sowing close to the carriageway where there is a high risk of damage by salt, such as on major priority routes identified by the winter maintenance programme (see Section 6.19).

If acceptable disturbed and new areas should ideally be left to re-colonise naturally, e.g. rock faces and where it is adjacent to existing good quality habitat.

6.8 Visibility Splays

This applies mainly to roads as many rural lanes and most RoWs do not have visibility splays except on new routes.

The main points are:

- Tall trees can often be retained within a visibility splay providing that lower branches do not represent a safety hazard; and
- Avoid creating new visibility splays where possible.
- Newly created splays should reflect the vegetation found on adjacent areas but should be of a low-lying nature. In all but the most urban settings new splays should be sown with wild flower seeds mixture (from a local UK source) rather than amenity seed mixtures (see **Section 6.7** above). A SCC ecologist can specify.

6.9 Drainage and Soil Movement **(including verge excavation, the creation and maintenance of ditches, grips, gullies, balancing ponds, service tunnels, trenches and pits)**

Where works involve verge excavation account should be taken of Special Road Verges, which may support legally protected and Somerset priority plant species. One flora species in Somerset, the perfoliate pennycress, is a European protected species and is found in verges around Charlton Mackerel. Other species are protected under UK law by the Wildlife and Countryside Act 1981 (as amended) from intentional and reckless picking or uprooting. These include rough marshmallow and starved wood sedge. Where the presence of these species conflicts with highway's works advice should be sought from a SCC ecologist as early as possible.

Ditches and water features are not usually County Council owned, but belong to adjacent landowners. The County Council owns some however where these have been built as part of a road scheme. Grips may be found in the verge and these can be the responsibility of the Highways Authority to maintain. Trenches and pits are often temporarily required for testing and cable work and also as part of the construction of highways, paths, bridges and fences/barriers/stiles.

The main points are:

- ***When creating trenches, ditches or grips*** avoid locations and methods that will result in serious damage to trees and hedges. Preferably all should be created by hand digging where trees and hedges (including their roots) might be damaged. If these operations involve tree branch or root surgery or even removal, then establish with the appropriate District Council whether the tree or hedgerow might be a protected one (see Section 6.4 above).

- ***Badly designed drainage openings/grills/gully pots*** can trap and kill significant numbers of small mammals, reptiles and amphibians in certain locations. If installing new openings consider this issue in selecting designs. See **Boxes 15 and 24 in Section 7** and the Design Manual for Roads and Bridges (DMRB) have some reference and advice on these matters. Similarly, *steep sided ditches* present an obstacle to amphibians and small mammals that may fall in and become trapped and drowned as a result. Features such as ramps should be designed in to enable wildlife to escape.
- ***Any open excavations or ditches*** should be provided with an internal ramp to enable small animals to escape should they fall in. Steep sided ditches present an obstacle to amphibians and small mammals that may fall in and become trapped and drowned as a result. Escape features should be provided to enable escape.
- ***Surplus soil*** should be removed from site. Topsoil should not be used as a verge surface except in amenity areas. The use of nutrient-poor subsoil benefits wild flowers and contributes to counteracting nitrogen deposition from motor vehicles.
- ***Where machinery is used***, such as tractors, mini diggers or large mechanical excavators avoid soil compaction especially where natural re-colonisation is chosen as the restoration method.
- ***Existing drainage pipes and culverts*** may shelter wildlife, such as badgers and otters, both temporarily and permanently. Care should be taken prior to the commencement of works involving the renewal of pipework and/or culverts.
- ***Culverts*** that transverse under the road should include a raised platform trackway on one side of the culvert that will enable otters, badgers and other species to use them to cross the road as a matter of course.
- ***Drainage features holding water*** require careful management and maintenance to be of biodiversity value. Where there is identifiable value (many sites) work needs to avoid unlawful actions if protected species such as water voles, great crested newts or otters are present (see **Table 4** above).
- ***For ditches with good aquatic flora and fauna***, clearance should usually be carried out in the late summer or early autumn (after the bird breeding season; when plants have seeded; and when water levels are low) and ideally the job should be done gradually in small sections over two to six years. See http://www.rspb.org.uk/countryside/managingreserves/habitats/ditch_creation/ditch_management.asp. This of course may not always be the most economic approach or the case where the requirements rare or protected species known or are likely to be present need to be considered. Consultation with a SCC ecologist and the Environment Agency, the Internal Drainage Board and/or Natural England may be necessary at some locations (see Section 7).
- ***Ditches and grips that have filled in*** with vegetation, debris, or been filled in by material pushed in where a heavy vehicle has mounted the verge, are usually dug out by machine, but on RoWs this is can sometimes be done by hand. The removed material should be taken away, but in reality it can be acceptable for small amounts of material to be spread out along highway land. Before doing this

however, make sure the land is not a designated site such as a Special Road Verge. If unsure of how to proceed then consult a SCC ecologist.

- ***If the land has been compacted and squashed in***, the resulting removed material may be used to reconstruct a bank that may previously have existed. Such banks can become new areas for grassland, hedgerows or trees.
- ***Reinstatement of verges*** should restore the natural soil profile and surface levels existing prior to work commencing. An uneven surface can create hazards for walkers and horse riders using highways; Reinstatement should restore the *natural soil profile and surface levels* existing prior to work commencing. Storing topsoil and subsoil separately is recommended and replaced in correct order in the restoration process. Imported topsoil should not be used as a verge surface except in amenity areas. The use of nutrient-poor subsoil benefits wildflowers and contributes to counteracting nitrogen deposition from motor vehicles. Pay attention to levelling as an uneven surface can create hazards for walkers and horse riders using highways. Surplus soils should be graded or removed from site.
- ***Verges should not be re-seeded*** without first obtaining advice from either a SCC ecologist. Amenity seed mixtures should never be used, except in built up areas.

6.10 Pot-hole Repair, Patching and Minor Highway Subsidence

Guidance in Section 6.9 is also relevant. It is vital that care should be taken to ensure that repairs to holes or depressions are not carried out where the tunnels or chambers of a badger sett are the cause of the collapse. Rabbit and other burrows occasionally cause structural problems and work should be carried out with regard for the Wild Mammals (Protection) Act 1995.

A SCC ecologist will be informed and a licence for the work needs to be obtained prior to the repair being carried out. Further details of procedures for badger damage are set out in Section 7.7.

6.11 Kerbing

These are more common in urban and semi-rural areas. Avoid the use of kerbing and badly designed drainage openings where it is next to good wildlife habitat, as they can trap and kill significant numbers of small mammals, reptiles and amphibians. Section 6.9 is also relevant to these operations.

In kerbed sections of the highway or where new kerbing are to be installed dropped kerbs should be formed in the run to enable these species to escape. (see Boxes 15 and 24)

6.12 Bridges and Structures

There are 1195 bridges in Somerset as well as other related structures such as culverts. Bridges can support or be associated with a number of species that are protected by law. The protected species include bats, otters, water voles, and badgers, nesting birds, reptiles and amphibians. Epiphytic flora attached to masonry and small mammals may also occur.

There are a large number of bridges that carry RoWs (footpaths, bridleways, RUPPs and BOATs) throughout the county. However until such time as a full network survey has been carried out we cannot confirm type, quantity or condition of these structures. The majority of RoW bridges up to a span of 7 metres are of timber construction. The PRow team install and repair up to a hundred bridges each year mostly foot and bridlepath ones. In the bulk of cases this means removing an old structure and replacing it with a standard kit footbridge or bridlepath bridge.

Some stonewalls (in common with bridges) may support protected species such as bats, nesting birds, reptiles and amphibians. Epiphytic flora (attached to walls) and small mammals may also be present

Before bridge maintenance or restoration works are confirmed an ecological survey including for the above species, should be produced and any mitigation incorporated into the design and construction brief and works programmed, if necessary, to avoid predicted impacts. Note that there may be a need to inspect a bridge immediately prior to the commencement of works to confirm absence or presence. Where a species is found to be present there may be a delay whilst the necessary licence is obtained.

Further information on which working methods to incorporate into bridge design and programming works can be found in the sections on otters, water voles and bats, white clawed crayfish, breeding birds (See **Sections 7.2, 7.4, 7.6, 7.8 and 7.12**).



It may not be necessary to use ecological consultants if works are deemed (by using this document) to have no or little ecological impact. However, **where a protected species is potentially affected and impacts eliminated due to process this must be documented**. Works such as bridge painting or fence erection can normally be progressed without specialist surveys and assessments however if unsure check with the County Council's ecologists.

When undertaking bridge maintenance or replacement activity, measures should be taken to maintain the quality of the water flow, including ground water, against silting and/or chemical pollution. Fresh mortar is very alkaline and can cause serious pollution to a watercourse. Particular care should be taken with the use of these materials when working on a structure near a watercourse. Reference to the Environment Agency's pollution prevention guidelines is recommended.

Any valued tree or shrub or habitat in the vicinity should be retained and protected, through the erection of a fence for the duration of any works. Vegetation (e.g. ivy and trees) will only be removed or managed from **December to March** and normally in advance of works. The exception is if there is a safety issue or after an incident, e.g. falling of a tree after a storm.

Provision within maintenance and replacement works should be given to introducing features to conserve or enhance biodiversity on/around bridges. Animal boxes and ledges/cavities/crevices can be incorporated into bridges and opportunities for providing them as appropriate should be taken up whenever possible (see **Section 8.5**).

New bridges should be designed to have a clear span and should never be full when a watercourse is in spate. A clear span bridge has enormous benefits in that it can take more water and allows the easy passage of wildlife.

6.13 Street Lighting

Lighting roads is a factor in reducing night time road traffic accidents. However there can be significant effects on wildlife that can be negative. Street lighting in areas of where rare species occur should be particularly considered.

Horseshoe, *Myotis* spp., and long-eared bats (all of which includes the more vulnerable species) are known to avoid artificial lighting whereas fast-flying bat species are attracted to feed on night flying insects attracted to the light (Natural England 1996, Outen, 2002). Therefore the installation of new street lighting can cause disruption or disturbance, which could make a roost site untenable. In other cases, new street lighting may form a barrier to bats crossing the landscape. Therefore where a scheme requires the installation of street lights a search should be made early in the process for the presence of roost sites and an assessment made of flyways. The siting of light columns should be planned accordingly (see '*Bats and road construction*', 2005).

Invertebrates are particularly affected. Street lighting is known to disturb flight, navigation, vision, migration, oviposition, mating, feeding and crypsis in moths (Natural England 1994, Outen, 2002). It also leads to increased predation, which may affect the population viability of rare species. Plant function and bird behaviour is also affected.

Street lamps should be maintained to utilise fittings that prevent lighting above the horizontal plane and so the beam points downwards.

Measures for adapting street lighting should include:

- Use of highly directional LED lamps;
- Fitting shades that restrict light to where needed; and
- Turn off lamps close to vulnerable sites outside key periods of human activity providing this does not put people at risk.

Where a scheme requires the installation of new street lights a search should be made early in the process for the presence of vulnerable species particularly bats and rare insects (see section 7, Box 6). The installation of new street lighting can cause disruption or disturbance, which could make a breeding site, roost or feeding site unusable or creating a barrier along flight lines denying access to feeding areas. The location of light columns and choice of bulb type and illumination area should be planned accordingly (see Limpens *et al* (2005) '*Bats and road construction*').

6.14 Surface Treatments **(including surface dressing and slurry sealing)**

Avoid spillage of dressing materials beyond the carriage onto nearby vegetation.

On RoWs, the rolling of soft surfaces should be kept to the minimum extent and frequency necessary to maintain safe access for users.

Guidance in Sections 6.9 and 6.10 is also relevant to these operations.

6.15 Miscellaneous Highway Structures & Furniture **(crash barriers, fences, signs, waymarks, stiles, gates and cattle grids)**

Fences and crash barriers may have overgrown vegetation at their base that will provide a niche for some small animals and certain plants.

Signs located within hedgerows/shrubs/trees will need vegetation to be cleared in front of them so as not to obscure the plate from approaching road or PRow users. The hedge/shrub/tree should be trimmed for the minimum amount in front of the sign so that it is visible to the on coming road/path user. This work should be carried outside of the bird-breeding season (autumn/winter). Cutting should be severe enough to prevent new growth obscuring the sign during the spring and summer months but not to permanently harm any important vegetation. If it is found that a sign has become obscured during the bird-breeding season the vegetation should be surveyed to ensure that no nest sites are present.

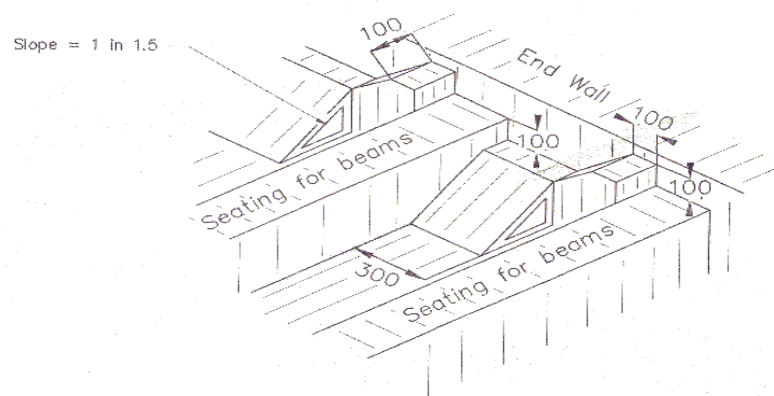
Do not attach signs, waymarks or fence cross members or wires onto trees if this can be avoided. Use posts instead or attach to other structures such as walls, fences, gates or stiles. Use of tanalised wood is appropriate, but so is heavy duty recycled plastic.

Use of aggregate and concrete in postholes is acceptable as long as excess is not left on site. Even better is the re-use of the dug out material from the hole around the post to make it firm.

Cattle grids are a major cause of mortality facing Hedgehogs and other small animals in the highways. Those that cannot escape from them will either die a slow death through starvation or by drowning if the cattle grid pit fills with water. Not all cattle grids have escape ramps in Somerset.

As part of routine maintenance and if not already present, as illustrated in the standard drawing below, ramps should be placed inside near the edge to form a series of steps to help small animals escape.

Figure 1: Cattle Grid - Small Animals Ramp



Isometric View Of Hedgehog Ramp (NTS)

6.16 Storage and use of equipment and materials

Care should be taken to prevent chemical contamination of wildlife habitats and features directly or via water, soil or air.

The main points are:

- Avoid physical damage caused by the movement and storage of vehicles, plant and materials;
- Consider installing temporary protective fencing for sensitive wildlife habitats and features. Consult either a SCC ecologist for advice if required; and
- Handle materials and equipment safely and in a manner that reduces the risk of pollution spills occurring, which would cause direct or indirect chemical contamination to biodiversity.

6.17 White Line and other Painting

Avoid spillage of paint beyond the carriage on to nearby vegetation. Any road kills should be removed prior to working and reported to a SCC ecologist.

6.18 Gully emptying and Drain Jetting Operations

These operations are carried out in situations where gullies and drains are blocked or becoming blocked. This is usually reactive in response to a flooding problem, and therefore can be carried out at short notice.

When working on culverts and drains operators need to be aware that they may shelter wildlife, for example otters and badgers. For example otters are known to use old culverts emptying into the watercourses in the town centres of Taunton and Bridgwater.

6.19 Winter maintenance

Compared to all other highway pollutants, salt is probably the greatest threat to vegetation especially if it is newly planted. Direct contact and absorption through root uptake can result in stunted growth, defoliation and death. Salt provides an attractive mineral lick that can sometimes attract deer and other animals to the roadside. There are also reports of finches dying after eating beechnuts contaminated by de-icing salt (Gloucestershire County Council, 2003). So for biodiversity (and economic) reasons, it is recommended that a 'Minimal Salt Programme' be adopted to reduce salt usage through accurate forecasting and improved application techniques.

It is recommended that 'early morning' inspections be carried out at night in marginal weather conditions. This is an attempt to be more accurate in determining when salt should be used and hopefully reduce the use of salt unnecessarily. Other measures to improve forecasting include use of additional sensors and the improvement of salt spreading to avoid over salting.

Locations of any new salt bins/heaps should be very carefully selected and kept away from important sites for biodiversity (Consult a SCC ecologist). Salt should ideally be kept in a covered building or in bins that have an impervious floor or bottom. All vegetation is susceptible to some degree, but areas in the vicinity of small streams and ditches should be particularly avoided.

Manage any large snow piles created that contain salt so that they do not sit for any prolonged time on or next to sensitive vegetation or left where they may melt into any important freshwater rivers, streams, ponds, lakes or wetlands.

Salt and salt spray on major routes does provide a niche for salt loving plants (e.g. common scurvy grass) but this is not really seen as a biodiversity gain as it is at the expense of other vegetation.

6.20 Control of Injurious Weeds

The five 'injurious weeds' covered by the Weeds Act 1959 (see Section 2.8) are:

- Spear Thistle (*Cirsium vulgare*)
- Creeping or Perennial Thistle (*Cirsium arvense*)
- Curled Dock (*Rumex crispus*)
- Broad-leaved Dock (*Rumex obtusifolius*)
- Common Ragwort (*Senecio jacobaea*)

Primary responsibility for the control of these weeds rests with the occupier of the land on which the plants are growing. Where a need for control is identified, care should be taken to use the most appropriate method for the circumstances of each site.

Defra has compiled three useful guidance notes which are obtainable on their website at <http://www.Defra.gov.uk/enviro/weedsact/default.htm>:

- The '*Code of Practice on how to prevent the spread of Ragwort*' should be followed in carrying out all measures involving common ragwort (see Section 2.8).
- The note PB4192 entitled '*Identification of injurious weeds*' is useful for those not familiar with the physical appearance of the plants involved. It can be easy to confuse species, e.g. St. John's wort (*Hypericum spp*) and ragwort. Indeed imperforate St. John's wort (*Hypericum maculatum*) is a rare county notable species found in road verges on the A361 between Shepton Mallet and Frome. Marsh ragwort (*Senecio aquaticus*) may also be confused with common ragwort where it grows. **Do not take action to control the plants unless they have been correctly identified.**
- PB7190 '*Guidance note on the methods that can be used to control harmful weeds*' covers measures relevant to the Weeds Act species.

Problems with these plants are often associated with disturbed land. Disturbed land is mainly associated with new or road improvement schemes but maintenance works can also provide disturbed conditions for weed species to thrive for a short time. Such problems will often resolve themselves on highway land, as grass will normally out compete the injurious weeds in the long term. The County Council receives very few complaints about the growth of the two dock and thistle species on highway land. Most reports received concern ragwort. This is mainly because ragwort is so obvious when in flower, when some toxin is present, and when in a dried state is poisonous to stock, especially horses.

It should not be forgotten that all of the five injurious weeds are native species and are important for biodiversity in their own right. They additionally provide food and shelter for a wide range of bees, butterflies, moths and other insects. Birds, especially finches, are especially attracted to the seeds of thistles and docks.

Good management of grassland will avoid most injurious weed problems. The key is to keep the grass sward tight to prevent seeds and seedlings from establishing themselves. Perennial weed plants will also be weakened if grass is allowed to regularly grow tall.

On highway land, troublesome ragwort concentrations should normally be cut which is best done before it flowers (i.e. **from June onwards**). Regular cutting each year should inhibit ragwort within 5 years. If the number of plants is not too great it may be pulled out by hand. In extreme cases herbicide applications may be the only option and should be done with hand held, back pack units, which can be used to spot, or area treat. The herbicide used should be one approved by the Environment Agency and /or Natural England. Defra has produced a '*Code of Practice on how to prevent the spread of Ragwort*' which is the key guidance document to follow to avoid transgression of the Weeds Act. For more information on control, see also the Defra

note entitled '*Methods that can be used to control harmful weeds*'. This is a key guidance document to follow to avoid transgression of the legislation.

General actions to prevent injurious weeds infestation (as long as these do not compromise more important issues of safety or nature conservation) include:

- mow only as frequent as is necessary and not too short so as to disturb the soil surface;
- minimise the area of land disturbed during other operations;
- make good any large disturbed area with appropriate sowing of native grassland (wildflower) seed or planting of trees and shrubs. Alternatively store grass turfs from disturbed areas, keep watered and then replace once works have been completed;
- control weeds in early years following verge disturbance and/or creation;
- prevent users of the highway eroding verges and banks;
- encourage adjacent landowners to adopt appropriate ragwort control measures (e.g. make them aware of the Ragwort Code of Practice).

Such actions will avoid many problems from arising but if there is a weed problem on adjoining land that is out of the council's remit then effective control may always be difficult. For more information see the Defra note entitled '*Preventing the spread of harmful weeds*'.

If any injurious weed plant material is to be removed from site, then contact the Environment Agency and the local District Council for advice on how and where to dispose of the material safely.

The spraying of other 'weeds' is sometimes done in formal areas and between crevices within hard surfaces of the highway. This is mainly an urban measure however.

For more information go to the Somerset County Council website
<http://www.somerset.gov.uk/roads-parking-and-transport/problems-on-the-road/report-weeds-on-the-road/>

6.21 Eradication of non-native plants

The Wildlife & Countryside Act 1981 (Section 14 & Schedule 9) makes it an offence to plant or cause the non-native species Japanese knotweed (*Fallopia japonica*) and giant hogweed (*Heracleum mantegazzianum*) to grow in the wild. Currently Himalayan balsam (*Impatiens glandulifera*) is not currently included in any legislation but is a threat to biodiversity by also excluding native vegetation. The Natural Environment and Rural Communities Act 2006 gave the Secretary of State power to approve a Code of Practice for selected invasive non-native species.

Currently Japanese knotweed is generally treated with an herbicide four times a year between April and October and over a period of four years.

The Environment Agency produces useful website information on the control of Japanese knotweed, giant hogweed and Himalayan balsam (*Impatiens glandulifera*). The National Trust has been having some success with stem injection of Japanese Knotweed with a glyphosphate herbicide which kills the plant and provides an effective long-term solution (see www.brownfieldbriefing.com/news/national-trust-claims-knotweed-knock-out).



Himalayan Balsam

(Courtesy: FWAG)

Parrot's feather (*Myriophyllum aquaticum*) and Canadian waterweed (*Elodea canadensis*) are examples of aquatic non-native plants that can be an invasive problem in roadside ponds and ditches. These are very difficult to eradicate. Winter eliotrope (*Petasites fragrans*) is increasing, including along roadside verges, and when in leaf obliterates native flora.

Where highways pass through or next to woodland invasive rhododendron (*Rhododendron ponticum*) may be present. This shrub will take over woodlands and shade out the ground flora (e.g. bluebells - *Hyacinthoides non-scripta*). Just cutting rarely controls it; digging out or herbicide treatment of triclopyr on stumps is usually needed to eradicate it.

Occasionally the butterfly bush (*Buddleja davidii*) may proliferate on drier verges and walls. This shrub is a good nectar source for butterflies and moths but if it is compromising other habitats and species or damaging masonry, then it may need to be controlled by cutting, digging out or spot treatment with an appropriate herbicide.

Another problem is the planting of cultivated daffodils into rural verges and hedgerows, as they affect native flora. Any requests should be considered in the context of location and further advice can be sought from a SCC ecologist.

If this or any other non-native plant material is to be removed from site contact the Environment Agency and the local District Council for advice on how and where to dispose of the material safely.

For more information go to the Somerset County Council website
<http://www.somerset.gov.uk/roads-parking-and-transport/problems-on-the-road/report-weeds-on-the-road/>

Japanese knotweed and other alien species growing within the highway should be reported to the Roads and Transport Team
Email: roadsandtransportSD@somerset.gov.uk; Contact no: 0300 123 2224 giving a map reference, extent and side of road, who will record the location on GIS for the HSPR and also arrange with a contractor for its eradication.

Further advice on how to proceed with a non-native plant problem contact a SCC ecologist who will then give advice following consultation with the Environment Agency. Websites that may also be useful can be found at <http://www.invasiveweeds.co.uk/> and <http://www.appliedvegetationdynamics.co.uk/iaapwebsite/>. Information on certain invasive non-native plants is also available on the Cornwall County Council website at <http://www.cornwall.gov.uk/environment/trees>.

6.22 Dealing with Emergencies

In cases where there is an emergency that involves a threat to the safety of people then this should be dealt with immediately and in the most appropriate manner. If the guidelines in this section of this document can be followed to preserve biodiversity then they should be, but only if the circumstances allow. If an SSSI is involved then Natural England should be informed as soon as it is practicable to do so (see Section 5.2).

7. Planning for Species – Design, Working Method and Licensing

7.1 Introduction

This Section outlines the requirements for species that need to be taken into account in the design and the specification of the working methodology of a scheme in order that legislation is complied with for protected species and /or that best working practices are adopted in line with the objectives of UK and local Biodiversity Action Plans (BAP).

Further information can be obtained either from a SCC ecologist.

7.2 Bats

Introduction

There are 18 species of bat in the UK all of which have been recorded in Somerset and of these 15 species have been recorded as roosting in the County. All species of bats are afforded protection under the Conservation of Habitats and Species Regulations 2010 (the 'Habitats Regulations') and from individual disturbance under the Wildlife and Countryside Act 1981 (as amended)



Pipistrelle Bat (Courtesy Natural England)

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Hedgerow Removal and Trimming
- Tree Removal and Trimming
- Scrub Removal
- Bridges and Structures
- Street Lighting

Scrub removal should be treated in the same way as hedgerow removal.

Hedgerow Removal or Trimming

Hedgerows often form important features for bats acting as flight lines to access feeding areas. Many bat species, including horseshoe, *Myotis*, long-eared and pipistrelle species are reliant on hedgerows. The bigger and more unmanaged hedgerows are preferred. A differentiation has been made between hedgerows below and over 2 metres high. Limpens & Kapteyn (1991) reported that linear features less than 1 metre high was seldom used by bats generally.

Hedgerow removal could potentially prevent bats from reaching feeding areas and also reduces available foraging habitat. This could then affect the numbers of bat a colony might support or indeed its continuing viability.

Some species of bat are also affected by gaps created in flight lines and will turn back rather than cross over. Again this prevents access to feeding areas. For example, greater horseshoe bats will only cross gaps in flight lines of up to 12 to 15 meters but are not crossed unless dark (Billington, 2000) and for lesser horseshoe bats gaps as little as 10 metres could prevent movement along a flight line (Schofield *et al*, 2002; Brinkmann *et al*, 2003)

Box 1 – Hedgerow Work and Bats

If a scheme proposes the removal of a hedgerow it will be required to assess the impacts on any bat colonies in terms of maintenance of the population. The Conservation of Habitats and Species Regulations 2010 (the 'Habitats Regulations') makes it an offence to '*...affect significantly the local distribution or abundance of a species to which they belong.*'

Any assessment will need to be carried out at a landscape level and can use tools such as the Species Alert Mapping to aid decision making.

Tree Removal and Trimming

Some species use trees as roost sites. These include *Myotis* species, such as Bechstein's, Daubenton's and Natterer's, and noctule and barbastelle bats. These roosts are most likely to be found in trees located in ancient woodland or parkland; large trees with complex growth forms; in tree species which typically form cavities, such as beech, ash or willow; trees that have visible damage caused by rot, wind, woodpeckers, lightning strike, etc.; and those trees with loose bark.

Tree felling can damage or destroy roosts in trees or disturb bats at roost sites. Trimming can have the same effect. Any trimming in the canopy around the roost site can subtly change the local environment making conditions unfavourable for bats. Damage does not have to be deliberate or reckless to be a potential offence. Roost sites are protected at all times even if bats are not present. Tree removal should be planned well in advance to allow for surveys. Tree roosts can be used in summer and winter.

Signs indicating possible use by bats include staining or scratches around a hole (this can be hard to spot), bat droppings in / around / below an entrance (bat droppings are ~ 1.5 to 3mm in size, dry and crumbly and sometimes remains of insects can be seen), and audible squeaking at dusk in warm weather.

Trees are classified as to the risk of presence of bat roosts as follows:

High risk – Trees, especially those which are large or mature, holding a range of features which could be used by bats. These include – woodpecker holes, rot cavities, long splits, thick ivy and/or a hollow core.

Medium risk – Trees holding some potential for bats although not especially suitable e.g. low ivy cover, few cracks.

Low risk – Trees lacking features listed above.

Box 2 – Tree Work and Bats

If a tree needs to be felled or trimmed as part of a scheme an assessment of the likelihood of the tree being a bat roost should be carried out by a SCC ecologist or a qualified consultant.

A preliminary survey should be undertaken as follows (Bat Survey Good Practice Guidelines, Bat Conservation Trust 2012):

- Use close-focusing binoculars to inspect trees from the ground to canopy
- Inspect all aspects of the tree
- Look out for features indicative of bat roosts. Use a high power torch, even in daylight, to inspect cavities and shaded areas of the branch structure
- For surveys in summer, listen for bats making audible calls
- If appropriate ask people (landowner / manager, walkers) if there is a history of bats using the site
- Record findings. It may be useful to mark the tree with tape or paint

Tree requiring removal and potential danger' trees (surgery required within 6 months) need to follow these steps:

High risk trees

Depending on the time of year this is likely to include further inspection using an endoscope or, in summer, dawn or dusk activity surveys. A SCC ecologist will then advise on how to proceed in the light of the survey results.

Note that if a roost is confirmed a licence will be required from Natural England (NE) before any work takes place. NE aim to determine applications within 30 working days of receipt of the application. The ecologist should be on site when surgery takes place if bats are known to be present.

Somerset Highways must ensure that the contractor is aware of and follows the ecologist's recommendations.

If a landowner wishes to carry out the works then he/she must be sent the consultant's report and made aware of relevant wildlife legislation.

Medium risk trees

No further survey needed but the contractor should be informed of the possible presence of a bat roost. The contractor should consider the best time of year to carry out the work as well as ensuring that best practice procedures are followed in order to minimise disturbance to bats that may be present. The contractor should be prepared to deal with any injured bats (through having gloves and a box to hand).

Contractors should be able to prove that they are experienced in dealing with trees which are, or may be, bat roosts, know what to do if (in extreme situations) they have to handle bats and that they are aware of the legislation – and have attended a training course (at their expense).

If bats are found to be present then work must stop immediately. The contractor should contact a licensed bat ecologist and ask them to come out on site immediately. The contractor and ecologist should decide on the best approach to take in each situation. If timber has already been felled, or the situation has become a safety issue, the contractor should follow best practice procedures prior to the ecologist arriving. The ecologist should be asked to send a report summarising any action taken, or which still needs to be taken, to the relevant officer in Somerset Highways.

Low risk trees

Any surgery can continue and further advice is not required.

'Imminent danger' trees (surgery required within 24 hours) need to follow these steps:

High risk trees

As soon as a high risk / imminent danger tree is identified Somerset Highways should contact a SCC ecologist make every effort to find a licensed bat ecologist who is prepared to be on hold for 24 hours and therefore to be on site ideally before work starts, or if a roost is found. Given that public safety must take priority the ecologist must be flexible and fit around the timetable of the tree contractor. A record should be made of who was contacted and the results of this.

The ecologist providing advice should provide a written report to Somerset Highways summarising action taken. This report should be copied to Natural England.

If an ecologist is not able to be present during surgery then the contractor should ensure that best practice procedures are followed in order to minimise disturbance to bats that are, or may be, present, see Box 1. The contractor should be prepared to deal with any injured bats (through having gloves and a box to hand).

If a bat roost is found, and an ecologist was not present, Somerset Highways should be informed immediately after the tree has been made safe. Somerset Highways should contact a County ecologist immediately and ensure that they visit the site and advise on next steps within 24 hours. Any works needed to ensure the safety of the bats should be carried out immediately.

Medium risk trees

The contractor should be informed of the possible presence of a bat roost and ensure that best practice procedures are followed in order to minimise disturbance to bats that may be present. The contractor should be prepared to deal with any injured bats (through having gloves and a box to hand).

If a bat roost is found Somerset Highways should be informed immediately after the tree has been made safe. Somerset Highways should contact a licensed bat ecologist immediately and ensure that they visit the site and advise on next steps within 24 hours. Any works needed to ensure the safety of the bats should be carried out immediately.

Low risk trees – surgery can continue. Further advice not required.

Summary guidance for minimising impact when bat roost not confirmed
(this is only guidance and no substitute for training)

BCT Bat Surveys, Good Practice Guidance – 'soft felling' is a generic term used to describe more cautious felling approaches, using lowering and cushioning

techniques to reduce the impact of felling limbs which may still have bats within cavities.

Arboricultural Association Guidance Notes - Tree & Bats:

Timing - work to trees with the potential for roosting bats is best done from late August to early October. This assumes that young bats are weaned and independent, whilst also being before hibernation.

Best practice

- Pruning or section felling should avoid crosscutting in proximity to cavities and hollow sections.
- Limbs with internal fissures must be pruned carefully to maintain integrity of the feature, whilst also ensuring that access is not restricted by future growth
- Sections containing cavities with the potential to contain bats must be left on site, ideally as high as possible off the ground, with any opening exposed for at least 24 hours so that bats can escape.
- Split limbs that are under tension may need to be wedged open to prevent their closure when pressure is released.
- If the tree is covered by a dense mass of ivy growth the thickness of foliage will soften the fall. The tree can then be left for 24 hours before limbing and removing ivy.
- Where there is only a partial covering of ivy it may be more appropriate to consider cutting the ivy at the base and completing necessary work when the ivy is dead and roosting potential removed.

If a roost / bat is found

- Contact a SCC ecologist immediately who will arrange to come out to site
- Bats that are exposed and injured should be placed in a well ventilated box prior to the arrival of the bat worker. A bat may be picked up without touching it by gathering in a loose cloth. Gloves must be worn. Box should be lined with tissue (kitchen towel) and have a cloth hanging over the side (to provide shelter). Water should be supplied in a jam jar lid.
- If timber with the roost is felled but the roost remains intact and bats are uninjured, temporarily seal the entrance and isolate the timber section. Position the section off the ground as high as possible and re-open the entrance

Bridges and Structures

Any bridge may be used as a bat roost at any time of year. Stone bridges are the most likely to provide suitable roost sites, particularly if over water, but concrete bridges may also be used and the abutments of steel and wooden structures can contain crevices which may be utilised by bats. bats have been found roosting in expansion joints of motorway bridges.

Signs to look for include bat droppings on the ground, on ledges or stuck to walls. These are mouse like, black or dark brown, between 4mm and 8mm long and easily crumble in the fingers. Urine stains may be visible on the wall and ark polished access holes are another sign caused by oil from bats fur. The presence or lack of cobwebs also provides clues. In addition, bats may be audible.

It is important to be aware of the possibility of finding bat roosts during regular bridge inspections. If a roost is found, then prior knowledge of its presence will make it easier to plan future works, and avoid delays². When bats are observed in, or in the immediate vicinity of, a Somerset County Council highway structure this must be registered in the structures records and the Somerset County Council ecological staff informed

‘A roost is protected whether bats are present or not. Effects on bats can range from direct killing (through crushing or entombment) to disturbance which, if occurring during the summer breeding season or winter hibernation period can indirectly result in the death of bats’ (Bat Conservation Trust, n/d).

Most bridge repairs or maintenance have the potential to disturb or damage bat roosts, particularly work involving:

- re-pointing
- pressure grouting
- trial cores
- re-building
- re-saddling
- demolition

If works disturb, injure or kills bats, destroys or damages a bat roost it will be a criminal offence unless correct procedures are followed.

In all cases where a bridge or other Somerset County Council owned highway structure is established (from whatever source) to provide a roost for bats this shall be recorded on the:

- Permanent Bridge File,
- SCC Bridge/Highway Structures Database, and on the
- Condition/Defect Record.

This shall be in order to assist future engineering activity to take appropriate precautions

Local Excavation in the Road over Bridges (i.e. ‘trial’ holes)³

There exists an occasional need to carry out small excavations in the road over bridges to determine the thickness of the structure or to locate buried items such as pipes and ducts belonging to utilities (e.g. Telecom, Water, Gas and Electricity). Whilst the road surface may require breaking open by machinery excavation in the vicinity of the structure and buried utilities, it is typically carried out with hand tools for safety reasons and to avoid damaging the bridge and / or the buried utilities.

² Design Manual for Roads and Bridges. Volume 10 Environmental Design And Management Section 4 Nature Conservation Part 3 Ha 80/99 Nature Conservation Advice In Relation To Bats

³ This section is derived from Radford, P. 2006. *Local Excavation in the Road over Bridges (i.e. ‘trial’ holes)* – Method Statement to Reduce Risk of Disturbing Bats. Taunton: Somerset County Council

The likelihood of a bat roosting on the top of a structure, underneath the road surface, is very small. From a technical standpoint Somerset's roads are typically subjected to 40 tonne heavy goods vehicle traffic and noise and vibration will be transmitted through the road surface. The effect of vehicle impact and compaction, as well as water seepage and detritus coming through from the road surface, make it very unlikely that there will be any 'bat friendly' voids and crevices around the top surface of a bridge under the road surface. Structural factors also determine that voids and crevices generally go up into the structure (for example a crack, mortar joint loss or spalling, say through frost or reinforcement corrosion) and do not result in hidden or unknown chambers or galleries fanning out horizontally from a void or crevice in the underside or soffit of a bridge.

Box 3 Trial Holes and Bats

To minimise any residual risk of disturbing bats whilst conducting this excavation activity in the road over bridges timing of the works should be taken into account. Bats may use some sites all year round but it is unlikely that they would occupy smaller crevices in mid-winter (January / February). Bats are vulnerable in June-August if it is a maternity roost and may be disturbed by heavier engineering works. Pre- planning of trial holes to avoid this summer period is required.

In all cases, prior to the undertaking of a trial hole, the underside (soffit) of a bridge deck or arch should be inspected and any soffit condition survey referred to by the engineer responsible for the work. This is in order to ascertain the presence of voids and crevices that could provide a roost for bats (i.e. those corresponding to the dimensions above). Inspection of the site may make it obvious that the site is not bat friendly for example where a site is totally submerged or there is clear evidence that the structure has recently run a full bore. In the light of this inspection there are four possible scenarios.

- *Scenario 0:* The bridge is not bat friendly; for example the structure is underwater or there is clear evidence that the structure has recently run at full bore or bridges where the work to be undertaken has no prospect of interfering with any area that could be remotely considered to be appropriate for bats to roost in. These situations would include any works to parapets and copings where vibratory plant or intrusive work is not undertaken and is free of crevices more than 50mm deep and 12mm wide.
- *Scenario 1:* Bridges where the underside is free from voids and crevices (corresponding with the dimensions given above) and/or where it can be firmly established by inspection at the time that any voids (e.g. surface loss of mortar from brick joints) are superficial only and not providing a roost for bats: The trial hole may proceed to best suit technical and safety requirements (e.g. in relation to the structure and traffic management on the road above).
- *Scenario 2:* Bridges where the underside has some local areas where there are one or more voids and crevices (corresponding with the dimensions above) where it is not possible, by inspection, to determine whether there are roosting bats. In such cases a trial hole shall only proceed where it is possible to locate (in 'plan' dimension) a trial hole more than 2 metres away from such a void or crevice. In practice, within the constraints of the site and safe highway working the trial hole should be located the maximum possible

distance away from such voids and crevices.

- *Scenario 3:* Bridges where the underside has widespread voids and crevices (corresponding with the dimension in bold italics above) such that it is not possible to locate a trial hole 2 metres or more away (in plan dimension) from the nearest void or crevice. In such cases a trial hole shall not proceed without appropriate and specialist ecological input to determine whether the proposed trial hole can be undertaken in a certain location without disturbing roosting bats. Contact a SCC ecologist.

Re-pointing and Minor Repairs

Bats are small and a crevice of no greater than 50mm deep by 12mm wide can be used as a roost or gain entrance to a void behind. A pipistrelle entrance hole need be no bigger than 20mm by 10mm. Optimal crevices are probably those that are at least 400mm deep and between 17-35mm wide. Bats can roost in tiny crevices which include:

- gaps between stones or bricks where mortar has fallen out
- drainage holes
- expansion joints
- other gaps and cracks between the various elements of the bridge structure
- voids and gaps in concrete structures.

Box 4 Re-pointing, Minor Repairs and Bats

For works involving re-pointing to crevices less than 25mm and repairs to damaged areas, such as parapets, the structure should be checked immediately before commencement of the works. This should include a visual search of such gaps or crevices as listed above. Where the back of a crevice or gap cannot be seen a dowel of 25mm diameter should be inserted, and removed when the mortar is set, to enable any trapped bat to escape. This would preserve the roost and prevent injury to the bat.

Should a bat or signs of bats, as described above, be identified work should not proceed any further and a SCC ecologist notified immediately.

Other Work to Bridges and Structures (including pressure grouting, re-saddling, re-building and demolition)

Any other work affecting bridges, other than re-pointing and trial holes, will need a full bat survey where there is a likelihood of bat presence, i.e. bridges with crevices, drainage holes, expansion joints, other gaps and cracks between the various elements of the bridge structure, and voids and gaps in concrete structures over 12mm wide.

Box 5 Work to Structures and Bats

A bat survey will be required. Therefore, when preparing a scheme this should be implemented in the first instance and should play an important consideration in

programming the works.

It will be important to determine whether bats are present or not as this will determine the working method for the scheme and its timing. Early erection of scaffolding to enable bat surveys to take place may be required.

Surveys should determine the potential of a bridge or structure to be used by roosting bats and allocated to one of the following categories:

- Low Risk: No features present that could support roosting bats.
- Medium Risk: Features present that are able to support small numbers of roosting bats such as males in the summer or the winter.
- High Risk: Features present that have the potential to support large numbers of roosting bats or hibernating bats.

Where a bridge or structure has a low risk of bat roosts being present works can be timed for any time of year.

No bridge works should be carried out if bats are present and bats should not be disturbed during the maternity season or during hibernation. Therefore as well as visual inspection emergence surveys are likely to be required to determine the size and type of roost present in Medium and High Risk categories.

Surveys should be conducted from **April to October** following Bat Conservation Trust guidelines (Bat Survey Good Practice Guidelines, Bat Conservation Trust 2012). Where time is limited surveys should concentrate on mid-August to October and if these show that there is evidence of bat presence these should be surveyed again in the following summer. Further work in spring to mid-summer is needed to identify nursery sites. (Billington & Norman, 1997).

The timing of works is also important. Where a roost is potentially present work will generally need to be timed as follows:

- Both Maternity and Hibernation roosts - April, May and October
- Maternity roost only – December to March
- Hibernation roost only – June to August
- Other roost – December to March and June to August

Knowledge of how bats are using the bridge may extend the periods given.

If bats are present work will be required to be carried out under licence from Natural England. This would usually be in **mid-April to mid-May** (if no nesting birds are present) and **late September to mid-November** when bats can be temporarily excluded under licence.

All bat roosts are protected in law whether occupied or not. Therefore, **it is essential where works will destroy or damage a roost another one is provided to replace that lost**. There are commercially available artificial roosts that can be incorporated into bridge or structure works. The environmental condition, function and size of the original roost should be considered in locating the replacement.

Street Lighting

The installation of new street lighting can cause disruption or disturbance to bats, which could make a roost or feeding site unusable or creating a barrier along flight lines denying access to feeding areas. Horseshoe, *Myotis* spp., and long-eared bats (which include the more vulnerable species) are known to avoid artificial lighting whereas fast-flying bat species are attracted to feed on night flying insects attracted to the light (Natural England 1996, Outen, 2002).

As an example, lesser horseshoe bats are known to be constrained by bright light conditions, which results in later emergence times than other bats (Duvergé *et al*, 2000) but would equally apply to the constraining effects of artificial illumination in the landscape (Outen, 2002). Mathews & Jones (2008) found that the presence of artificial lighting disrupted the flight activity and foraging ecology of lesser horseshoe bats. They found that the species made no passes in their trial where metal halide light was used. Metal halide (mostly bluish white) is brighter and contains more ultraviolet light than SON (mostly yellow) lighting. Even when SON was used only one pass was recorded. A study (Stone *et al*, 2009) has shown that lesser horseshoe bats are disrupted from flying along hedgerows by artificial light levels above 0.5 Lux. It was also found that continued disruption increased the effect, i.e. lesser horseshoe bats do not become habituated to the presence of artificial lighting and would therefore permanently disrupt their behaviour.

Street lamps also have an effect on prey availability (Outen, 2002; pers. comm. Emma Stone, University of Bristol). Whereas they do not sustain insect populations *per se* but attract insects from the surrounding natural environment. Therefore, as a consequence of attracting the insects, depletes prey availability for light sensitive bat species, such as lesser horseshoe bats, in surrounding zones. In addition, the more common pipstrelle bats will feed around street lamps on the same insects as that of the rare lesser horseshoe bats (Crucitti & Cavalletti, 2002).

Street lamps should be maintained to utilise fittings that prevent lighting above the horizontal plane and so the beam points downwards. The location of light columns and choice of bulb type and illumination area should be planned accordingly (see Limpens *et al* (2005) '*Bats and road construction*').

Box 6 Street Lighting and Bats

Schemes will need to be designed in consultation with a SCC ecologist.

Before the installation of street lights it must be ascertained whether they will affect the movement of bats across the landscape. Bat colonies may be cut off from feeding areas or then removal may increase the likelihood of fatalities to bats which in turn may affect the maintenance of a local population, i.e. it's 'favourable conservation status'.

Lighting schemes will need to show, under Regulation 41 of the Habitats Regulations, that there is no adverse effect on the 'Favourable Conservation Status' of a bat population following installation where appropriate. This can be disturbance at a roost site and /or to a flight line or feeding area.

Measures for adapting street lighting could include:

- Use of soft white LED lamps;
- Fitting shades that restrict light to where needed;
- Fit ultra violet filters to existing mercury lamps;
- Fit light on demand lamps; and
- Turn off lamps close to vulnerable sites outside key periods of human activity providing this does not put people at risk.

6.3 Common Dormouse

Introduction

The common (or hazel) dormouse is afforded protection under the Conservation of Habitats and Species Regulations 2010 (the 'Habitats Regulations') and from individual disturbance under the Wildlife and Countryside Act 1981 (as amended)

The common dormouse is nocturnal. It lives and feeds among the branches of trees and shrubs and rarely descends to ground level except when hibernating. It is important that it can move from tree to tree shrub to shrub without descending to the ground. (Bright et al, 2006)

The common dormouse is found in deciduous woodland, hedgerows, and edges of conifer plantations, wet woodland, reed beds with alder and bramble; and overgrown gardens. They can also be found in scrub with grassland/ heathland (Chanin & Woods, 2003)

Dormice using hedgerows were all found to have a minimum height of 3.7 metres and width of 2.3 metres; the width being of more importance. Nonetheless dormice have been found in managed hedgerows as little as 1 metre wide and 1.5 metres tall they are more likely to occur in large, less frequently cut hedgerows. In Dorset, dormice have been found in hedgerow habitat with no significant areas of woodland within 2 – 3 kilometres. It should also be noted that dormice have been found in Somerset in managed hedgerows of less dimension than afore cited. *Their absence should not be assumed simply on the basis of a 'non-typical' habitat.* (Bright et al, 2006)



Common Dormouse (Courtesy: Natural England)

Being arboreal, and unless as a dispersing juvenile, narrow gaps in hedgerows are barriers to dormice. Non-corridor habitats of more than 100 metres, i.e. managed hedgerows, are also considered a barrier to movement (Bright, 1998; Büchner, 2008).

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Hedgerow Removal and Trimming
- Tree Removal and Trimming
- Scrub Removal
- Street Lighting

Scrub removal should be treated in the same way as hedgerow removal.

Any proposals falling within the areas identified in the Species Alert Mapping for the species will require a survey if suitable habitat is affected, including that which is sub optimal. However, there is likely to be unrecorded locations of dormice populations across the County and consideration should be given to the context of the hedgerow or scrub within the landscape. Isolated trees are not likely to support dormice but a network of well-connected hedgerows is more likely to host a population. The location of the intended hedgerow removal in relation to surrounding hedgerows and woodland is very important. Potentially by removing any hedgerow, even for a small gap, will fragment dormouse habitat and cause populations to be split into two thereby reducing its likelihood of survival in the future. Hedgerow in such situations will always require licensing and replacement hedgerow planted to re-join the ends of that severed. Consult a SCC ecologist.

Hedgerow, Scrub and Tree Trimming

Box 7 Hedgerow and Scrub Trimming and Dormice

As dormice hibernate in the winter any trimming of hedgerows, scrub or trees should take place between **November and February** depending on weather conditions at the beginning and end of the period.

Hedgerows should be maintained to a minimum height of 3 metres and preferably 4 metres.

In locations where dormice are present overhanging trees forming a 'tunnel' should be maintained as otherwise clearance will form a barrier to movement and is likely to sever populations of the species so that they are isolated and more vulnerable to local extinction. Where this situation occurs, contact a SCC ecologist. A licence is likely to be required in order to carry out the work where overhanging trees need to be trimmed back.

Hedgerow, Scrub and Tree Removal

Box 8 Hedgerow, Scrub and Tree Removal and Dormice

Hedgerow removal may illegally cause death, injury or disturbance to dormice, destroy or damage nest sites or may cause habitat fragmentation isolating populations and perhaps reduce the ability to disperse.

Before removal of hedgerows and/or scrub it will be necessary to determine presence or absence.

Where the hedgerow is not part of a corridor then use the following guidance if less than 50 metres long.

Hedgerows under 50 metres long

If removing 50 metres or less of hedge/scrub that would not fragment a population then assess the likelihood of dormice being present

If the hedgerow or scrub is very gappy and not close to good habitat (dense scrub, woodland or large thick hedges) it can be considered of low risk and dormice do not need to be considered further.

If not of low risk then follow guidance below:

- a. Remove the entire hedge/scrub (including roots) using hand tools during **October** when dormice still active. A licensed ecologist should check the site for nests immediately before clearance and, if needed, during clearance. If an above ground nest is found it should be left in situ and no vegetation between it and the adjacent undisturbed habitat should be removed until dormice have gone into hibernation (December).
- b. If (a) is not possible then remove above ground vegetation using hand tools between **December and February** when dormice are hibernating at ground level. Again a licensed ecologist should check for nests and / or brief the contractor on site immediately prior to work starting. The roots and stumps can then be cleared in **May** when dormice have come out of hibernation.

Hedgerows over 50 metres in length

If removing more than 50 metres of hedge/scrub then contact a SCC ecologist to assess the need for a survey.

No single survey method is suitable to determine presence. A combination of methods should be used. Note the length of period and timing of the surveys as work will need to fit in with these constraints and that of carrying out mitigation as outlined above should the work be permitted under licence. The following methods can be used:

- Nut search where hazel is present - best between September and December. A search for nest sites may also be undertaken. This method is of limited use.
- Nest boxes placed at a density of 30 per hectare about 1.5 metres above ground level. Can be used between May and October but requires a licence. Use in woodland.

- Nest tubes about 15 centimetres long with one end blocked and an inner wooden section with an overlap of 3 to 4 centimetres are placed and left in situ between **April and November**. An Index of Probability is set out in the Dormouse Conservation Handbook (Bright *et al*, 2006) and survey period between April and November should reach a score of 20 and is therefore going to take several months. Tubes in hedgerows should be set at about 10 to 20 metre intervals.

If dormice are present a licence will be needed from Natural England. Robust mitigation demonstrating how the Favourable Conservation Status of the dormouse population is maintained will need to accompany the application and could include methods listed in b) above and replanting hedgerow to provide the habitat to support the population. It should also be noted that any replacement habitat would need to be mature enough to provide support for dormice and may take several years to achieve.

Street Lighting

The common dormouse is nocturnal. The installation of new street lighting is likely cause disruption or disturbance to dormice, and would make feeding site unusable or create a barrier along a hedgerow denying access to feeding areas.

Any proposals falling within the Consideration Zone of the Species Alert Mapping for the species will require a survey if suitable habitat is affected, including that which is sub optimal. However, there is likely to be unrecorded locations of dormice populations across the County and consideration should be given to the context of the hedgerow or scrub within the landscape. Isolated trees are not likely to support dormice but a network of well-connected hedgerows is more likely to host a population. Potentially street lighting illuminating any hedgerow can fragment dormouse habitat and cause populations to be split into two thereby reducing its likelihood of survival in the future.

Box 9 Street Lighting and Dormice

New lighting affecting dormice habitat is likely to require licensing and adequate mitigation provided to prevent light illuminating dormouse habitat. Consult a SCC ecologist.

Measures for adapting street lighting could include:

- Fitting shades that restrict light to where needed;
- Fit highly directional, and/or light on demand; and
- Turn off lamps close to vulnerable sites outside key periods of human activity providing this does not put people at risk.

7.4 Otter

Introduction

The otter is afforded protection under the Conservation of Habitats and Species Regulations 2010 (the 'Habitats Regulations') and from individual disturbance under the Wildlife and Countryside Act 1981 (as amended).

Otters are found on all types of watercourse including canals, ponds, lakes and reservoirs. They use tiny ditches and streams including dry watercourses as regular commuting routes. They usually follow watercourses, either swimming or running along the bankside, but may commute overland to reach ponds, lakes and other water bodies, or to access other river catchments. (Grogan et al, 2001)

It is important to recognise any watercourse as a habitat and wildlife corridor, along which many species may disperse or migrate and that all watercourses have potential as otter habitat (DMRB, Vol. 10, Sect 4, Part 4, 1999).

Otter in Somerset are generally nocturnal and use undisturbed holts and couches in which to rest up. Holts or dens are found in the roots of trees, heaps of sticks or rocks, drains, badger setts, rabbit burrows, etc., where the chance of physical disturbance is low. These are usually within 10 metres of the watercourse but can be up to 50 metres away. Couches occur in thick vegetative cover. Otter holts are usually tunnels in riverbanks among roots and boulders. Holts are known to occur in urban areas but are likely to be closer to a watercourse than in a rural setting.

Holt sites are located in areas away from human disturbance and can occur up to 50 metres away over dry land (Chanin 1993). Natal holts seem to be located away from main watercourses and from water altogether even being found 500 metres away. However, most sites are within 3.5 metres of water. Breeding sites are generally located on but not restricted tributary streams (width 0.7 to 4 metres). (Chanin, 2003)



Otter (Courtesy: Natural England)

Main habitat types for otter breeding sites are: reed beds; ponds and lakes; deciduous woodland (ranging from 20 metre strip to several hectares); young conifer plantations; and extensive areas of scrub. Structures or buildings immediately adjacent to a watercourse may be used occasionally. Mature sycamore and ash trees are important as potential holt sites. Other species used include rhododendron bushes, oak and elm trees. (Liles, 2003)

Otter breeding sites require security from disturbance; one of more potential natal den sites; play areas for cubs; no risk of flooding; and access to good food supply. (Liles, 2003)

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Hedgerow Removal and Trimming
- Tree Removal and Trimming
- Scrub Removal
- Bridges and Structures

Tree/ Scrub Removal

It will be necessary to ensure that otters are not disturbed and their resting places not destroyed or damaged. Otters occur on watercourses throughout Somerset. Resting places are located in areas away from human disturbance and can occur up to 50 metres away over dry land. They can also occur in urban areas, e.g. the centre of Bridgwater and Taunton. Otters can be prone to human disturbance and bankside works may affect resting places causing damage or destruction of resting places.

Box 10 Tree and Scrub Removal and Otters

If there is undisturbed reed bed, scrub or woodland in proximity to the water body check with a SCC ecologist. Damage or destruction of resting places is not permitted unless licensed. Removal of dense vegetation, removal of material, such as dead wood, rubble, etc., and thinning, coppicing or pollarding trees, and ground excavation could affect otters.

Tree roots and driftwood can often host resting sites, which are usually holes in the bankside. Therefore, prior to any removal or work to trees they should be checked to determine presence.

Areas of scrub next to water bodies may also support otter resting places, such as couches, and will need to be checked before clearance. Otter resting places occur in wetlands, such as the Somerset Levels and Moors, in ponds, on the banks of rhynes or in reed beds.

Surveys can take place at any time of year but may require a licence if intrusive methods are required.

Any work which may destroy or affect an otter holt should be discussed with a SCC ecologist. Where a holt or suitable habitat for couches may be affected, expert advice should be sought in the context of the surrounding habitat, the availability of other sites and the possible construction of an artificial holt. The loss of resting places will place more stress on the animal requiring it to move further in order to find suitable cover. This in turn may place it in conflict with other otters or put it at risk to other hazards.

Work affecting holts will require a licence from Natural England. If a holt site is destroyed a replacement is likely to be required to replace that lost as part of the licence conditions. There may be timing constraints if a female with cubs are affected.

Bridges and Structures

Work in the vicinity of a resting place, holt or couch may be considered to cause disturbance, especially if used by a female with dependent cubs and may need to be timed for the appropriate time of year. Bridges and structures themselves may provide opportunities for laying up places.

Box 11 Structures and Otters

A survey for resting places in suitable habitat within 50 metres of the works should be undertaken.

Alterations to bridges and culverts must consider the effects of those changes on otters. Road mortality is a possibility if otters are unable to pass under bridges or through culverts when the watercourse is in spate. In addition, otters will often travel upstream on land. Therefore, it is essential that means by which otters can pass under bridges or through culverts are provided.

The provision of a ledge will allow otters to pass above watercourses at spate level. These can be made of solid concrete construction as an integral part of the bridge or made of gabion baskets. Alternatively they may be from steel or other durable material and bolted onto the side of the bridge. Another type of ledge is a floating pontoon of hardwood with a polystyrene core. All ledges should be 30 to 35 centimetres wide. They must be designed not to obstruct flow or floating debris during flooding. If the bridge is a listed structure the County Council's Heritage Service will need to be consulted before such ledges are constructed.

Other examples of mitigation designed to would negate the potential for mortality are shown in Grogan et al, 2001⁴.

7.5 Great Crested Newt

Introduction

The great crested newt is afforded protection under the Conservation of Habitats and Species Regulations 2010 (the 'Habitats Regulations') and from individual disturbance under the Wildlife and Countryside Act 1981 (as amended).

Great crested newts can be found in ponds of all types and where one is particularly favourable numbers can grow to large proportions. The species needs extensive good wild habitat with plenty of invertebrate food for the period outside the breeding season when it spends time on land. As a result they are less commonly found in gardens but it is by no means unknown. Hedges and ditches enhance the suitability of a site. Terrestrial habitat includes grassland, scrub, marsh and wetland habitats surrounding ponds and lakes. Great crested newts can be found in rural, urban and post-industrial settings. Areas of grassland, scrub and woodland around ponds (especially within 250 metres) are important for shelter, food and hibernation sites.

⁴ Grogan, A., Philcox, C. & Macdonald, D. 2001. *Nature Conservation and Roads: Advice in Relation to Otters*. Oxford: Wildlife Conservation Research Unit. Culverts are covered on p48.



Great Crested Newt

Adult great crested newts spend the majority of the year in terrestrial habitat. They head towards ponds to breed from around March to June. They hibernate in terrestrial habitat generally from mid-October to February / mid-March.

Great crested newts are known to disperse up to 1.3 kilometres (English Nature, 2001). Kupfer (1998) recorded movements of between 230 and 1290 metres in an open agricultural landscape. Most of the dispersal of great crested newt populations is undertaken by the juvenile and immature newts, up to one or two years old.

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Hedgerow Removal and Trimming
- Scrub Removal
- Verge Excavation and Storage
- Pond and Ditch Clearance
- Kerbing works
- Gully construction

Hedgerow / Scrub Removal

Any hedgerow or scrub removal within 500 metres of a pond may destroy great crested newt resting places, or kill or injure animals. The Species Alert may bring up locations of known great crested newt habitat. However, all hedgerow or scrub removal should be checked for proximity to ponds.

It is considered that hedgerow or scrub removal between 250 and 500 metres from a pond is unlikely to have an effect on great crested newt populations if of short length or limited area and procedures followed as set out below.

Box 12 Hedgerow and Scrub Removal and Great Crested Newts

Where hedgerow or scrub removal takes place within 500 metres of a suitable pond surveys of the pond should be carried out between **mid-March and mid-August**, dependant on weather conditions. Adults may be surveyed between mid-March and mid-June in ponds, eggs between April to mid-June and tadpoles between mid-May and mid-August. A minimum of four visits is required. There are several survey methods:

- Torchlight survey – during breeding season (No licence required if animals are not disturbed)
- Bottle trapping – particularly between mid-March and April
- Egg searches
- Netting – for tadpoles

Terrestrial habitat surveys for great crested newts can be undertaken within 500 metres of a breeding pond. These can be carried out between **March and September** by using pitfall traps and amphibian fencing. Alternatively refugia, such as searching under logs, stones and other hiding places, can be done especially outside the breeding season. However, not finding anything does not mean that great crested newts are absent. A licence is required to conduct surveys. Hot or dry weather is unsuitable survey weather.

If great crested newts are absent then work can proceed without constraint except where other species may be affected.

If no surveys are carried out it must be assumed that great crested newts are present in terrestrial habitat within 500 metres of a pond.

Any vegetation clearance in areas where great crested newts are present should be done by hand during the **autumn** when animals are still active but not breeding. February/ March and late summer should be avoided. The hedgerow or scrub should cut down by hand to height of 10 centimetres. Any refuges, log piles, rocks, etc should also be removed by hand. This should render the habitat sub optimal and the newts should move away to find more favourable habitat just prior to hibernation. The scrub or hedgerow can then be removed after November.

Verge Excavation and Storage

Excavation in verges, including trenches for drainage, grips, gullies, soakaways and service tunnels, post holes or foundations for safety structures (also along rights of way) within an area which potentially supports great crested newts as shown on the HSPR or Species Alert Mapping needs to use the following procedure:

Box 13 Verge Excavation or Storage and Great Crested Newts

Work should only be carried out between late February and October when great crested newts are active. Vegetation should be cleared by hand to a height of 10 centimetres and cuttings removed over the working area of the scheme immediately before commencement of the scheme, i.e. within 3 days. This will make any habitat sub optimal and encourage newts to seek alternative shelter.

If work is to take place between November and February a SCC ecologist should be consulted

Pond or Ditch Clearance

Box 14 Pond or Ditch Clearance and Great Crested Newts

Great crested newts are absent from water bodies between February and August as adults and larvae can be present until the beginning of October. Therefore, any work to ponds or ditches, including balancing ponds, within areas on the HSPR or Species Alert Mapping should be carried out between **mid-October and January** only.

However, if access to clearance may effect great crested newt terrestrial habitat and guidance given under 'Verge Excavation and Storage' needs to be followed before any machinery used in clearing water bodies is brought on site. Machinery will need to be confined to these areas.

Note that any water body supporting great crested newts will be required to be replaced and a licence from Natural England will be needed to carry out the works.

Kerbing and Gully Construction

Great crested newts will move across roads. The installation of kerbs along roads is likely to present an insurmountable barrier to the movement of great crested newts. This is particularly threatening to populations when the kerbs are located between terrestrial habitats and breeding ponds.

Gully pots in roads are potential death traps for great crested newts especially during migrations between terrestrial habitat and breeding ponds

Box 15 Kerbing, Gully Pots and Great Crested Newts

Where great crested newts are or are potentially present drop kerbs should be placed in runs every 20 metres at maximum to allow continued passage of newts across the road.

New roads may need to have amphibian tunnels installed.

To mitigate for the risk of killing great crested newts the ironwork of gully pots should be located 50mm away from the face of a kerb and a fillet of concrete installed slightly sloped toward the gully. This method has been successfully used by the Vale of Glamorgan Council.

7.6 Water Vole

Introduction

Water voles can occur on slow flowing watercourses throughout Somerset including in urban areas. Water voles are protected from intentionally or recklessly killing, injury and disturbance, and their burrows from damage or destruction under the Wildlife and Countryside Act 1981 (as amended).

Water voles favour vegetated banks but avoid overhanging trees and scrub.

Water voles are typically associated with slow flowing permanent water, a dense fringe of aquatic plants, growing in or near water, and steep banks (Macdonald et al, 1998). Optimum habitat requirement is for greater than 60% marginal and emergent vegetation with less than 20% tree cover and a watercourse less than 1 metre wide and 1 metre deep, which has static or sluggish water flow rates, and is adjacent to fens, rough grassland, improved grassland or urban areas. The best sites have highly layered bankside vegetation with tall grasses, stands of loosestrife, willowherb, nettles or meadowsweet often fringed with a thick stands of sedges, rushes or reeds. (Strachan & Moorhouse, 2006)



Water Vole

Each water vole uses a series of burrows that extend back to about 2 metres from banks above water. Earth banks are important for tunnelling and providing vegetative cover. Steep banks allow water voles to construct burrows at a number of levels above and below the waterline. A nest is built of reed and grasses at the back of the tunnel. (Macdonald et al, 1998)

Field signs include tunnel entrances above and below the water line. There is usually a cropped 'lawn' around the tunnel entrance. Paths and runs at the water's edge, runs into vegetation and footprints may be observed. In addition feeding stations, chopped vegetation and /or latrines may be seen.

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Bridges and Structures
- Ditch, Rhyne and Pond Clearance

Bridges and Structures and Ditch, Rhyne and Pond Clearance

Box 16 Structures and Ditch or Rhyne Clearance and Water Voles

Note the period for carrying out any work affecting water voles is limited to **February and March**.

A survey for burrows within 20 metres of the works of structures may need to be undertaken. Advice should be sought from a SCC ecologist.

Where ditch clearance is proposed the entire length of the site should be surveyed and at least 50 metres either side of the intended work. It is assumed that clearance will be done from the adjacent highway affect both banks of a ditch using a ditching bucket.

Surveys for water voles should be carried out between **late April and early October**. These should be from both banks of the watercourse.

Where present within works area they should be planned so as to avoid damage or destruction of burrows. Where damage or destruction to burrows cannot be avoided water voles will need to be displaced but only to a limited extent in **February and March** under the supervision of an ecologist. This is when water voles have emerged from winter activity and is prior to giving birth. Larger scale works will require trapping under licence.

Where ditch clearance is required and water voles are present the absolute maximum length of clearance should be 10 metres provided there is sufficient adjacent habitat. (Gow, n/d) Advice should be sought from a SCC ecologist.

Displacement consists of:

1. Removing vegetation with a strimmer so that only bare earth remains in a small section around the burrow(s). This needs to be at least to the top of the bank and the bank top.
2. Arisings should be raked off and removed.
3. A check should be made of the burrows to see if they have not become blocked. The area should be monitored daily for signs of water voles.
4. After three days undertake a destructive search of the affected area, which includes excavating burrows by hand.
5. Works should then proceed immediately. In some cases vole proof fencing may need to be installed or the area strimmed daily.

Displacement should only take place in mild weather conditions.

7.7 Badger

Introduction

Badgers are afforded legal protection by the Protection of Badgers Act 1992.

Badgers live in family or natal groups and are territorial. A family group usually consist of six to eight adults. A badger family's territory occupies from 14 hectares to 300 hectares but averages around 50 hectares and has sufficient food to maintain the group throughout the year. Latrines, shallow pits with dung, can be found near setts, or sometimes within, but are also important markers of territorial boundaries.

The badger's home is called a sett. A sett is a burrow consisting of tunnels and chambers. These vary in size. There are several setts in a territory, which may be occupied at different times of year or used by individuals of the group. Tunnels are typically have a domed roof and flat floor and are usually between 25 to 35 centimetres wide and 17 to 25 centimetres tall. Entrances are usually not less than 25 centimetres in diameter.



(Photograph by Darin Smith)

Four different types of sett have been classified as follows:

Main Sett

Each territory has one main sett. These are in continuous use, are large, well established and often extensive and have large spoil heaps outside of tunnel entrances. There are likely to be well-worn paths leading from the sett. It is in this sett that cubs are usually born. The closure of main setts is unlikely to be acceptable.

Annexe Sett

These occur in close association with the main sett and are usually found within 150 metres. They are linked by clear paths. An annexe sett consists of several holes but is not necessarily in use all the time. A second litter of cubs may be raised in this sett.

Subsidiary Sett

These setts usually consist of five entrance holes or more but are not in continuous use. They are found some distance from the main sett, at least 50 metres. There is no clear path to the main sett.

Outlying Sett

Outlying setts consist of one or two holes only and have small spoil heaps. The amount of spoil is an indication of the setts extent underground. They can be found anywhere in the territory. There are often no obvious paths and rabbits or foxes can also occupy them.

As well as setts, badgers have 'day nests'. These are shallow depressions lined with dry grass and leaves, usually under fallen logs or within a dense patch of bramble. Although called 'day nests' they are usually occupied for short periods during the night. Unlike setts these are not legally protected.

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Carriageway Repairs
- Hedgerow Removal
- Tree Removal
- Scrub Removal
- Bridges and Structures

Surveys for badger setts can take place at any time of year.

Pot Hole Repair, Patching and Highway Subsidence

Highway Damage

The indicative signs of damage to the carriageway caused by badger excavations under a road are a depression or cavity in the surface. However, by no means are all depressions in the road the result of badger activity.

Another cause for concern in terms of safety is where there is a hole at the edge of carriageway caused by badgers digging an entrance hole to their sett at the roadside. If tunnels are found as a result of maintenance operations work should be suspended immediately until the site can be fully investigated. Badgers are also known to use surface water drainage pipes over 225mm diameter, usually temporarily, as setts.

If there are any signs of badger damage, suspected or actual, it should be immediately reported to an SCC ecologist

Highway Safety

It is essential that the safety of the public using the highway is maintained and that any potential accidents due to badger damage be averted. It is illegal to obstruct a badger sett. **Therefore in no circumstance should a cavity be filled with any material** as this constitutes an offence under the Protection of Badgers Act 1992.

The damaged area should be coned or barriered off with the appropriate warning signs. The site should be checked regularly so that these remain in place.

If the carriageway is of insufficient width to allow the passage of a HGV then the cavity or depression should be covered. A metal plate should be placed over it and secured on four sides with tarmac. It should be checked regularly for movement and replaced as necessary.

If the damage is more extensive the road must be closed under an emergency road closure order.

In an emergency and in the absence of the above contact: Natural England Wildlife Management Team 0845 6014523

Procedure

In all cases the following procedure should be carried out:

1. Incident reported to a SCC ecologist by the superintendent
2. Superintendent arranges for damage to be plated if necessary or in some circumstances an emergency road closure
3. If necessary a joint visit can be carried out by a SCC ecologist and the superintendent
4. A SCC ecologist will:
 - a) Apply for to Natural England for a licence
 - b) If necessary a joint visit will be carried out by the highways ecologist and the Natural England advisor
 - c) On receipt of the licence inform the superintendent that it has been received
 - d) The superintendent will arrange for the works to be carried out on site, including obtaining any stats, and arrange a time and date with the highways ecologist. As the licence holder the highways ecologist must be on site.

All work to the badger sett must be done under the supervision of the licence holder. The day before the work is to be carried out the Highways Superintendent/Technician is to confirm with licence holder that it is clear to proceed with the work.

The licence will normally specify one of two types of working. Licences are each considered individually and can cover a wide range of work.

Permitted Work Period

Work to badgers setts may normally only take place between **July and November**. An exception may be made in the case of an extreme emergency or in situations where cubs would not be affected, such as at outlying setts. Sites with damage will have to be safeguarded until the 'open season'.

The licence will give start and end dates within the season between which it allows operations to take place. If the time period appears likely to be exceeded a request for an extension should be made before the existing licence expires or a new licence must be applied for.

Work on site will not be permitted unless the licence holder is present.

Site Work

A sett closure may be required where it is considered that the repair can only be carried out under sett closure due to the high probability that badgers will be injured or killed by the work. This usually is linked to full road reconstruction. The sett may be artificially recreated or closed altogether.

Live Working

'Live' working is where excavation can be carried out on a live sett where badgers can be present ('key hole surgery'). This can include extending the sett entrance into the verge with piping.

If licence conditions permit a 'live dig' may take place. This will involve carefully excavating out the depression or cavity to reveal tunnels. A mechanical excavator may be used to remove the tarmac but the rest of the work should be by hand at the discretion of the licence holder. Use of a digger or requirement to dig by hand will be specified in the licence.

Revealed tunnels should be reconnected using 300mm diameter pipe specified in the licence. This may involve cutting and fitting pipes into junctions. Pipes should be partly filled with soil from the vicinity in order to 'naturalise' the pipe – badger tunnels are 'D' shaped. Where the excavation reveals a chamber only the hole can be backfilled without pipework. However, it is vital that tunnels are not cut off.

The artificial extension of sett entrances at the edge of a carriageway is usually carried out as a 'live dig'. Sett entrances may be extended away from the edge of carriageways by the insertion of a metre length of 300mm diameter pipe, as specified in the licence. A trench is dug and the pipe fitted under the road construction so that the new entrance is facing away from the road into the verge. Generally the entrance should be gently sloped up from the sett. The pipe is partially filled with soil from the site to create a 'D' shaped section and to 'naturalise' the artificial tunnel. Once placed and fitted soil from the site is landscaped over and around the pipe to replicate a natural sett entrance.

Licences for 'live digs' will often require that suitable cage is available to take injured badger to the vets. If this occurs work should be suspended and the badger transported for treatment. Normally the Quantock Veterinary Practice, Bridgwater (01278 450080) will accept badger cases, although other vets in Somerset are willing to treat.

In the case where there are orphan cubs these should be captured and taken to Pauline Kidner, Secret World, New Road, East Huntspill, Highbridge, 01278 783250 (24 hours).

Sett Closure

Where the licence requires the sett to be closed it will specify the methods to be used. Badgers are normally excluded using one-way gates. Details of the construction of one-way gates can be found in '*Problems with Badgers?*' published by the RSPCA or refer to Technical Advisory Note WM10 published by Defra. http://www.Defra.gov.uk/corporate/regulat/forms/cons_man/vertpest/wm10.pdf

It may be necessary to trim away any vegetation surrounding the sett entrances before gating.

Gates are placed over each entrance hole so that they open outwards but are blocked for inward movements. This will prevent badgers re-entering the sett once excluded. The gaps between the gate and the tunnel entrance should be blocked with stones and soil. Once in place ensure that the door opens and is not obstructed.

Gates will usually require netting to the surrounding areas. This should be of wire mesh, preferably Mesh Weld security fencing which is available (Mole Valley Bridgwater Code 12284) in 25 metre rolls, 1.8 metres high with a 37.5mm square grid. This will prevent badgers digging around the sides of the gates to regain entry. Sticks are set in the ground just inside the gate and leaning against the 'door'. Fallen sticks will indicate that badgers have been present.

The sett needs to be visited regularly and all gates checked. This will be specified in the licence and is usually at three-day intervals. Sticks should be reset and the gate doors checked to see that they remain free-swinging.

Normally gates should remain in place for three clear weeks before work can commence. The time period will be specified in the licence. If badgers regain entry the gating period starts over again from the time of exclusion.

The gates are removed immediately prior to construction and entrances kept free. Work can go ahead using mechanical excavators, etc.

After excavation the sett can be reconstructed artificially under the carriageway or the badgers excluded altogether by wire meshing the verge. Generally creating an artificial sett under the road gives some control over their activity in situ and is preferable to exclusion. Badgers are persistent in returning to sites of former homes and will build a new sett along the road from the one that they have been excluded from thereby starting the problem over again. If exclusion is chosen an artificial sett should be constructed in the verge nearby in an attempt to forestall this behaviour. Closures of outlying setts do not present such a problem.

Hedgerow, Tree and Scrub Removal / Verge Excavation

Prior to the commencement of works the area to be removed or excavated should be surveyed for badger setts. This should be carried out well in advance of the works commencing to allow time for licensing procedures and possible exclusion measures.

If a sett is found, the scheme should first be amended to accommodate the badgers rather than disturbing a sett if possible. In any case a licence will be required from Natural England to carry out the work, due to at least disturbance from proximity of the activity. This may be a development licence rather than one to prevent damage. Where a main sett is affected it is unlikely that a licence will be granted.

Licence applications are required to include details of the scheme and proposed mitigation measures. Therefore measures such as provision for the loss of foraging habitat within the scheme and the construction of artificial setts to replace compromised setts six months prior to the commencement of works should be included where appropriate.

Bridges and Structures

Badger setts are known to occur within the structure of bridges, for instance enlarging cavities behind wing walls. These are most likely to be outlying setts. The same procedures outlined for repairs to the carriageway need to be followed.

7.8 Nesting Birds

Introduction

All wild birds are afforded protection from intentional killing, injuring or taking, their nests whilst being built or in use and their eggs from being taken or destroyed under the Wildlife and Countryside Act 1981 (as amended).

In addition, birds listed on Schedule 1 of the Act are additionally protected from intentional or reckless killing, injuring or taking, disturbance while building a nest, in or near a nest containing eggs or young, and to the dependent young.

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Hedgerow Removal and Trimming
- Tree Removal and Trimming
- Scrub Removal
- Bridges and Structures
- Street Lighting

Hedgerow, Tree, Scrub Removal and / or Thinning

As a general rule, it should be assumed that birds will be nesting in trees, scrub, reeds or substantial ditch side vegetation during the core breeding period, unless a survey has shown this not to be the case. Although the breeding cycles of most birds are well known, because they are triggered by seasonal changes, there are no fixed dates indicating when site work may be carried out. The legislation is tied to the reproductive cycles of the birds themselves, irrespective of when they choose to breed. Although most people think that birds nest in trees scrub and hedgerows, almost any feature on a site could potentially harbour a nest.

Box 17 Vegetation Removal or Thinning and Birds

Any work to hedgerows, trees and/or scrub should be carried out outside the bird nesting season. Generally the bird nesting season should be considered to be between **late February and August** but is dependent on weather conditions.

Schedule 1 birds are also protected from disturbance. Those species likely to be encountered during works on the highway include:

- **Cetti's Warbler** occupies dense scrub in low-lying wetlands where there is bramble and willow with reed beds close by. Works close to these types of habitat should be carried out outside the bird nesting season. The Species Alert Mapping⁵ provides a layer of known nesting sites.
- **Marsh Harrier** has successfully bred at Westhay Moor and Ham Wall in recent years but is very prone to disturbance. Any work between **April and September** within 500 metres of these sites should be avoided, check with a SCC ecologist. The Species Alert Mapping has a layer of known nesting sites.

An additional aspect is the presence of over-wintering food such as the seeds and fruits of trees and hedgerows and ruderal plants (weeds) on adjoining road verges. In order to preserve this vital pre-winter food source no work should occur following the breeding season **until the end of October**.

⁵ M:\MapInfo\GroupData\Somerset Species Alert Mapping.

Bridges and Structures

Work to bridges may affect riverine bird species such as kingfishers and dippers.

Kingfishers are listed on Schedule 1 of the Wildlife and Countryside Act and are therefore additionally protected from disturbance whilst at the nest and rearing young. Therefore works to structures over watercourses where kingfishers are breeding should take place outside this season which runs between **February and August**.

Kingfishers require relatively shallow and slow moving watercourses with vertical banks of fairly soft material in which to excavate nesting burrows linked with thriving populations of small fish on which to feed. They need overhanging tree branches and snags in the watercourse on which to perch during hunting. (Boag, 1982)

The Species Alert Mapping contains a layer of known areas where kingfishers have known to be breeding, and a SCC ecologist can be consulted.

Dippers are protected whilst nesting. They are found on fast flowing streams and rivers in uplands, such as on the edges of Exmoor. They nest between February and June. Nests are within 1 metre of the watercourse and sites include riverbanks, ledges, riverside walls, tree roots, and especially **holes and ledges under bridges** (Holden & Cleaves, 2002).



Dipper (Andrew2606 at [en.wikipedia](https://en.wikipedia.org))

Box 18 Structures and Birds

Work to bridges may affect riverine bird species such as kingfishers and dippers.

Works to structures over watercourses where **kingfishers** are breeding should take place outside the season between **February and August**.

Work should not take place between **February and June** to structures associated with watercourses where **dippers** are likely to be present. If not possible surveys for dipper nests should be undertaken. Advice should be sought from a SCC ecologist.

Marsh harriers and **Cetti's warblers** may also be affected. See Box 16.

Lighting

Street lighting can have an effect on the behaviour of birds. New street lighting is likely to cause disturbance to nesting birds and would constitute an offence to those listed on Schedule 1 whilst on the nest or rearing young.

Box 19 Lighting and Birds

Although an offence would only be committed if a Schedule 1 bird is affected it is recommended that any new lighting or alterations to existing lighting should take place outside the bird breeding season, which runs between **February and August**.

Where it is not possible to avoid works involving new or altered lighting within the bird breeding season a survey should be made for nesting sites within 50 metres of the works. Advice should be sought from a SCC ecologist.

7.9 Barn Owl

Introduction

Barn owls are afforded protection under the Wildlife and Countryside Act 1981 (as amended) where they are listed on Schedule 1. They are protected from intentional or reckless killing, injuring or taking, disturbance while building a nest, in or near a nest containing eggs or young, and to the dependent young.



Barn Owl (*Peter Trimming*)

Barn owls hunt over low-lying open farmland and require extensive areas of rough, un-grazed or lightly grazed grassland found in fields, field margins, parkland, orchard and/or newly planted plantation. Barn owls have bred in all months of the year but the majority of eggs are laid in April and May. The young fledge at around 9 weeks old and have normally dispersed by 14 weeks following hatching. Second and, occasionally, third broods may occur.

Major roads will normally cause the complete absence of breeding barn owls within 500 metres of the road, severe depletion of population up to 2.5 kilometres away and with some depletion up to around 8 kilometres distance (Ramsden, 2004).

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Hedgerow Removal and Trimming
- Tree Removal and Trimming
- Scrub Removal

Hedgerow, Tree, Scrub Removal and / or Thinning

When removing hedgerows, trees or scrubs adjacent to the highway the potential effects on increased mortality to barn owls should be considered. Young barn owls are susceptible to a high casualty rate from collision with vehicles using the highway. Approximately 49% of the young are lost in Devon (Ramsden, 2004).

Box 20 Vegetation Removal and Barn Owls

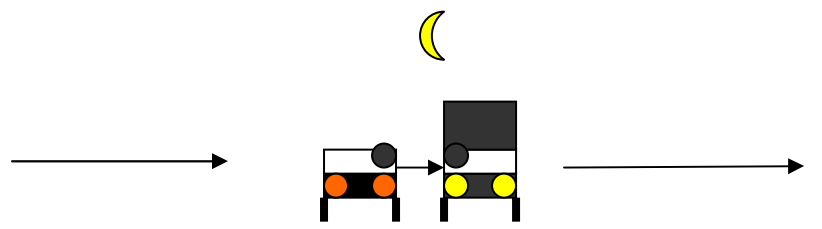
The Species Alert Mapping gives known locations of barn owl activity. Even so, when removing lengths of hedgerow, trees or scrub alongside the highway a SCC ecologist. The length of hedgerow may need to be replaced with new planting to avoid risk to barn owls.

Advice should be sought from a SCC ecologist.

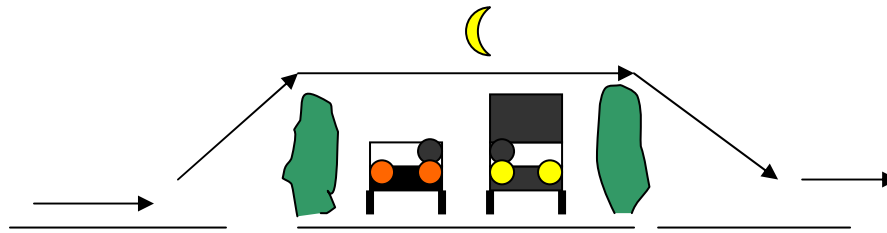
Vehicle turbulence is believed to knock many barn owls to the ground where they die of hypothermia/shock. Thick tall hedgerows along highway boundaries are required at casualty 'hotspots' to elevate the flight path of barn owls reducing collisions with vehicles (see Figure 2) (Garland, 2002)

Figure 2: Barn Owl flight path over embanked roads with and without boundary hedgerows (Garland 2002)

Low hazardous flight path over a road



Boundary hedgerows elevate flight path over a road



7.10 Reptiles

Introduction

All species of reptile are protected under the Wildlife and Countryside Act 1981 (as amended) from intentional or reckless killing or injury.

There are four species of reptile present in Somerset. These are:

- Common (or Viviparous) Lizard
- Slow Worm
- Adder
- Grass Snake

The common lizard is found in open habitats such as moors, heathland and natural grassland with sunny aspects and free draining soil. They hibernate from late October to early April in underground burrows or recesses in rocks and logs. They mate in spring and live young are born with a thin membranous egg three months later. Common lizards are fast moving and feed on invertebrates such as beetles. They frequently bask in sunshine.

The slow worm is found in a wide variety of habitats providing that they offer sunny basking areas. These are typically woodland margins, undisturbed grassland, heathland, road embankments and gardens (where domestic cats are absent). They hibernate between October and April. They mate in late spring and live young are born in early autumn. Their main food is invertebrates, such as slugs and worms, which they hunt at night. Slow worms conceal themselves under ground level debris, woodpiles, rocks, etc.

The adder is found in heathland, open woodland, rough and natural grassland, and in coastal dunes. Adders hibernate between October and March. Following mating in spring the female gives birth to live to about a dozen live young. The adults prefer small mammals as prey, which they use venom to kill following a lunge and bite.

Grass snakes are an amphibious species found in lowland areas, which have ponds, marshes and fens, including alongside ditches and rhynes in the Somerset Levels and Moors. Grass snakes hibernate between October and March/April. Following mating in spring, eggs are laid in a mound of decaying vegetation. The young hatch in July. Grass snakes feed on amphibians and occasionally small fish.



Adder (*Quantock AONB Service*)

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Hedgerow Removal
- Scrub Removal
- Verge Excavation and Storage
- Ditch, Rhyne and Pond Clearance (grass snakes only)

Hedgerow and Scrub Removal

Box 21 Hedgerow or Scrub Removal and Reptiles

A desk study of the site proposed for hedgerow or scrub clearance should be made to ascertain the suitability of habitat for reptiles and should include consultation with the Species Alert Mapping. Advice should be sought from a SCC ecologist.

For maintenance schemes and smaller highways development schemes the following procedure should be followed:

- Any features such as rubble piles which potentially afford resting places for reptiles will be dismantled by hand by a suitably qualified ecologist between April, May and October and any individuals found translocated to an appropriate location prior to works commencing on site.
- Any vegetation in the construction area should initially be reduced to a height of 10 centimetres above ground level by hand, brushings and cuttings removed and the remainder left for a minimum period of 48 hours of fine warm weather before clearing to minimise the risk of harming/killing any reptiles that may be present and to encourage their movement onto adjoining land. This work may only be undertaken during the period between April and October.

For larger development sites where a survey for reptiles is needed this should be carried out between **April and September**, particularly during April, May and

September when reptiles are most active. These should be carried out between 9 a.m. and 11 a.m. and 4 p.m. to 7 p.m.

Survey should consist of:

- A walk over survey should be conducted at a slow pace looking 3 to 4 metres ahead. A minimum of ten site visits should be made. Surveys should also be combined with the use of refugia.
- Refuges, of corrugated iron or roofing felt, should be placed at about 10 metres apart along the hedgerow or on a grid. These should be about 0.5 to 1 metre square. Ideally these should be placed on site in the previous winter. These should be checked fifteen to twenty times between **April and October** and any reptiles found recorded.

If surveys show reptiles are present, or where no survey has been carried out the following procedure should be used.

- Vegetation clearance in preparation of works will need to be programmed to take place between **mid – September and February** when reptiles are in hibernation. The area of proposed works would be made sub-optimal for reptiles by cutting all bramble, other scrub, grass and herbs down to ground level using steel bladed strimmers. Most reptiles would be expected to emerge from hibernation sometime during March.
- At the beginning of **April** any significant vegetative re-growth will need to be removed and cut down to ground level to retain the area in an unsuitable state for reptiles from all potential habitats. Leave two small islands consisting of vegetative cuttings, each measuring approximately 2 metres in diameter within the area of proposed works. All other arisings from the vegetative clearance would be removed from site. The aim of this is to encourage any reptiles that are still within the area after fencing to move toward these islands where they can be caught beneath strategically placed reptile refuges.
- Following the April vegetative clearance, reptile fencing would be installed around the cleared area. The fence installation would follow any second clearance of vegetation by around five days, which is considered sufficient to allow the majority of any remaining reptiles time to move away from the area of proposed works in search of adjacent cover. A specialist contractor would be employed to install the fencing. Large pieces of rubble and other debris, beneath which reptiles can shelter, would also be picked up by hand and removed to the development boundary in a wheelbarrow. Rubble and debris will not be cleared in winter as hibernating reptiles might be disturbed and their welfare compromised.
- The fence will be checked on a regular basis to ensure that it has not been vandalised and would remain in place until just prior to the commencement of works. Fencing the site ensures that it remains reptile free if the scheme is delayed for any reason.
- Between **early April and mid-May**, any reptiles within the fenced reptile exclusion areas that were not originally displaced by the vegetation clearance will be captured and translocated. Refuges will be installed and regularly checked in suitable survey weather conditions, until five visits have been made during which no reptiles are caught. Translocated reptiles should be moved to suitable

receptor sites and the process should include consideration given to habit

Ditch, Rhyne and Pond Clearance (Grass Snakes)

Box 22 Ditch, Rhyne or Pond Clearance and Reptiles

Consult the Species Alert Mapping for areas of known grass snake activity and if found to be present or working in a wetland area clearance should take place between **April and September** when the species is active. Vegetation should be cut down by hand to 10cm on the banks of the water body affected so that habitat is made sub optimal. Any piles of rubble or wood should be dismantled by hand. Work can then commence two or three days afterwards.

Verge Excavation and Storage

Box 23 Verge Excavation and Storage and Reptiles

A desk study of the site proposed where verge excavation or the storage of materials is planned should be made to ascertain the suitability of habitat for reptiles and should include consultation with the Species Alert Mapping. Advice should be sought from a SCC ecologist.

Work should take place in the active season between **April and October**. Vegetation should be cut down to 10cm above ground level about 3 days before work commences on site to make the habitat sub optimal.

7.11 Amphibians

Introduction

This section covers all amphibian species except great crested newts which are covered in a previous section. The common toad is listed on Section 41 of the Natural Environment and Rural Communities Act 2006 as a species of principle importance in England. All other amphibian species are unlisted or unclassified.

Amphibians congregate between February and June for mating and egg laying following their emergence from winter hibernation. They may be observed in large number migrating between their terrestrial habitat and ponds. Common toads are known for their mass migrations, migrating from their hibernation sites in woodland to their breeding ponds between February and April.

Tadpoles develop, grow legs and emerge onto land during the summer and autumn, dispersing back to suitable habitat away from breeding ponds. They return to their place of birth to breed after two or three years. Common toad tadpoles leave their natal ponds between June and early August.

Amphibians spend most of the year in terrestrial habitat and need damp moist conditions such found in woodland, under hedgerows, scrub and log piles. Frogs are found in rough grassland.

Both species of newt, other than great crested newts, prefer small pools and ponds and smooth newts will use ditches and garden ponds. Common toads and common frogs make use of ponds; lakes and reservoirs to breed and the latter are even known to breed in woodland puddles. Generally amphibians prefer ponds that are not too heavily choked by plants or silt and lack shading by trees.



Common Toad (Courtesy Jim Forster/ Natural England)

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Grass Cutting
- Ditch, Rhyne and Pond Clearance
- Kerbing
- Gully Construction

Amphibians are subject to road mortality when migrating between hibernation sites and breeding ponds in spring. Temporary 'Toad' signs may be used but consideration should be given to constructing an underpass (see Section 11.13).

Grass Cutting

Box 23 Grass Cutting and Common Toad

Grass cutting operation should not be carried out in the migration period of common toads. This runs between February and April. Juveniles are dispersing away from ponds between June and early August. Therefore, any grass cutting operation should be carried out **after early August** at toad migration sites. This will prevent vegetation being cut too short when juveniles are migrating away from pond sites exposing them to an unnecessary risk of predation.

Known toad migration sites are included on the Special Road Verge layer of the HSPR and are listed on the Froglife website.

http://www.froglife.org/toadsonroads/maps_active.htm

Ditch, Rhyne or Pond Clearance

Any ditch, rhyne or pond clearance should take place outside the breeding season which is runs from **early August to February**.

Kerbing and Gully Construction

Common toads will move across roads on migration. The installation of kerbs along roads is likely to present an insurmountable barrier to their movement. This is particularly threatening to populations when the kerbs are located between terrestrial habitats and breeding ponds.

Box 24 Kerbing, Gully Pots and Toads

Any kerbing work should consider the presence of ponds over 200m² within 1 kilometre of the scheme.

A desk study should be undertaken to assess the likelihood of the section of road affecting toad movement. Unless it is a known migration route (see http://www.froglife.org/toadsonroads/maps_active.htm) surveys should be carried if there is considered a possibility of a migration route. These should take place between **February and April** and can be undertaken using pitfall traps along the section of road concerned.

Where toads are found to be present or where no surveys have been carried out drop kerbs should be placed in runs every 10 metres at maximum to allow continued passage of amphibians across the road.

New roads may need to have amphibian tunnels installed.

Gully pots in roads are potential death traps for common toads especially during migrations between terrestrial habitat and breeding ponds. To mitigate for the risk of killing common toads new gully pots for drainage should be avoided on migration routes and alternative forms of drainage employed.

Existing gully pots on toad migration routes have been provided with mesh covers which are used during the season to prevent toads falling in and removed afterwards. This has been used at Hawkridge Reservoir in the Quantocks for example.

7.12 Atlantic White-clawed Crayfish

Introduction

Atlantic white-clawed crayfish are the only crayfish species native to the UK. They are afforded protection under the Wildlife and Countryside Act 1981 (as amended) from being taken, i.e. being handled, only. Nonetheless it is a feature for which a Special Area of Conservation may be designated being listed on Annex II of the Habitats Directive. Populations of species listed on Annex II are required to be maintained at Favourable Conservation Status. The white clawed crayfish is also listed on Section 41 of the Natural Environment and Rural Communities Act 2006 as a species of principle importance in England.



Atlantic White-clawed Crayfish (*Natural England/ Paul Glendell*)

The white-clawed crayfish requires fast flowing, shallow, calcareous watercourses with gravel-bottomed or pebbled stream beds, where they hide in gaps under larger stones or live in holes in the banks.

In habitats with flowing water the white-clawed crayfish may be found associated with:

- Undermined, overhanging banks.
- Sections exhibiting heterogeneous flow patterns with refuges.
- Under cobbles (juveniles) and rocks in riffles, and under larger rocks in pools.
- Among roots of woody vegetation, accumulations of fallen leaves and boulder weirs.
- Under water-saturated logs.

In winter white-clawed crayfish spend time in refuges in amongst the roots of bank side trees, and in crevices within walls, bridges, weirs, dams and canal washes.

The white-clawed crayfish are found in a wide variety of habitats ranging from deep water-filled quarries with a soft substratum to shallow fast-flowing streams but are typically found in watercourses of 0.75 metres to 1.25 metres deep. The species may occur in very shallow streams (about 5 cm of water) and in deeper, slow-flowing rivers (2.5 metres).

White-clawed crayfish are able to spread along a watercourse for a distance of at least 3 kilometres, maintaining the genetic homogeneity within the population. Even small barriers, such as weirs, may limit the movements of white-clawed crayfish and have the potential to limit connectivity within populations and prevent expansion or re-colonization.

Records of white clawed crayfish presence in main rivers are kept by the Environment Agency. Within Somerset watercourses supporting white clawed crayfish occurrences are rare. The main locations where they have been recorded are:

- River Mells
- River Sheppey (culverts through Shepton Mallet)
- River Alham
- Batcombe House Tufa Spring and Cistern
- River Brue (Bruton)
- Lopen Brook
- Dairy Field, Chard
- River Tone (above Tonedale Bridge)

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Bridges and Structures

Bridges and Structures

Box 25 Structures and White-clawed Crayfish

Work to structures, such as reconstruction and re-pointing of walls, and removal of vegetation adjacent to a watercourse may affect white clawed crayfish. Where such work is to be carried out in the watercourses listed above a survey should be undertaken to determine presence. A licence is required to survey for white clawed crayfish. **July to October** is the best time for crayfish surveys but they can be carried out in other periods of the year.

A manual search should suffice for the area affected by the works and a minimum length 10 metres either side. This method should only be used in water less than 60cm deep. In deeper watercourses trapping may need to be used and 'vole friendly' traps employed in carrying out the survey.

If alien crayfish, e.g. signal crayfish, are found they should be reported immediately to the Environment Agency.

Works should not take place in late May and June when crayfish are releasing young. Works should be scheduled for the period between **July and October**. Work could take place between November and March but only if unavoidable.

Removal or translocation of crayfish will require a licence from Natural England

Precautions need to be taken when working in watercourses where crayfish are present. These should include:

- Where alien crayfish are present all equipment and vehicles which have been in water need to be cleaned of mud. These should then be disinfected with hypochlorite bleach or an iodophor (at least 100ppm available iodine)
- If working in a watercourse where alien crayfish are present ensure that all equipment and vehicles that have been in the water are cleaned of mud

- If using a pump put a mesh screen to avoid taking in crayfish or fish
- If digging the bed of a channel retain and store surface stone for reinstatement
- If dredging avoid doing it too thoroughly by leaving some areas un-dredged, especially at the margins
- If excavating gravel back washing can help increase removal of small crayfish
- Provide replacement habitat if works involve permanent loss of habitat
- Prevent any pollution of the watercourse

7.13 Lesser Silver Water Beetle (and other aquatic invertebrates)

Lesser silver water beetles (*Hydrochara caraboides*) are protected from intentionally or recklessly killing, injury and disturbance, and their resting place from damage or destruction under the Wildlife and Countryside Act 1981 (as amended). Other aquatic invertebrates are cited on the Somerset Levels and Moors Ramsar designation. It should be noted that these species also occur outside the designated site and are regarded as ecologically supporting the Ramsar designation and works affecting them will also likely to be subject to a 'test of likely significance' under the Habitats Regulations 2010. Several species of aquatic invertebrates are also listed on Section 41 of the Natural Environment and Rural Communities Act 2006 as a species of principle importance in England.



Lesser Silver Water Beetle

Lesser silver water beetles are potentially present in seasonally inundated, late-successional ditches with some tree shading or in areas of wooded swamp. The adult can be found throughout the year but peaks between March and June. Breeding probably occurs during this period and eggs are hatched by early June. (Boyce, 2004)

The larvae do not mirror the catholic tastes of the adults. Pregnant females are very particular about choosing a pool before constructing an egg cocoon. Eggs are often laid on frog-bit. The larvae are totally carnivorous preying on aquatic water snails.

Optimal pond conditions where egg cocoons are constructed and larvae mature:

- Shallow water, generally less than 20cm deep. This could be as a separate temporary pool that completely dries up in the summer or as a wide, shallow shelf of an otherwise permanent pool. Immature lesser silver water beetles require warm water, found in shallower areas of ponds.
- Clean water that does not come from a highly eutrophic source (which often leads to cloudy conditions caused by algal blooms etc).
- Over 2/3 of the water without excessive growths of duckweed or filamentous algae.
- A thick layer of leafy or other organic detritus that has formed at the bottom of the pond.
- Abundance of invertebrate prey
- Bands of emergent vegetation, such as sedges, grasses or herbs where later instar larvae hunt and rest.
- Presence of suitable cocoon building material, such as frogbit, pondweeds spp., Water, or overhanging trees such as willow spp. and oak spp.
- Muddy shores and/or small floating rafts of vegetation for pupation
- Absence of fish.

(Boyce, 2004)

Table 5 below sets out information on a number of other rare aquatic invertebrates found in the Somerset Levels and Moors that may be present outside of designated sites and potentially affected by ditch, rhyme or pond clearance.

Table 5: Aquatic Invertebrates

Species	UK status	Somerset status	Habitat
<i>Valvata macrostoma</i>	IUCN Vulnerable; RDB 2; UK BAP Priority Species; NERC species of principal importance.	Rare, only found on West Sedgemoor.	Range of freshwater ditches in long established aquatic habitats.
<i>Odontomyia ornata</i>	IUCN Vulnerable; RDB2; UK BAP Long List.	Localised, records throughout Brue and Parrett floodplains.	Grazing marsh species, larvae like slow-flowing ditches.
<i>Lejops vittata</i>	IUCN Vulnerable; RDB 2.	Very rare with records from coastal Combwich area and Burrowbridge.	Freshwater; standing and slow-running freshwater bodies supporting stands of reeds, bulrush or club-rush.
<i>Hydaticus transversalis</i>	Nationally scarce;	Somerset lowland wetlands a national stronghold; scattered records in both Brue and Parrett floodplains.	Most frequently associated with ditches in grazing levels that are rich in emergent and submerged macrophyte vegetation.
<i>Dytiscus dimidiatus</i>	IUCN Near Threatened; RDB 3.	SL&M a national stronghold; records from 7	Occurs in ponds, ditches and open fen, usually where there is plenty of submerged and

Species	UK status	Somerset status	Habitat
		10km squares.	emergent vegetation.
<i>Hydrophilus piceus</i>	IUCN Near Threatened; UK BAP Long List.	Records throughout lowland Somerset including the Brue and Parrett floodplains.	Favours late succession grazing marsh ditches.

The following operations have been identified in Table 4 as potentially requiring measures to ensure legal compliance:

- Ditch, rhyne and pond clearance

Ditch, Rhyne or Pond Clearance

Box 26 Ditch, Rhyne and Pond Clearance

Where rare aquatic invertebrates are potentially present presence / absence surveys for aquatic invertebrate should be carried out of the section of water body affected by the works.

Sampling should be carried out for a period of 3 minutes from the bank using a standard pond net. Samples may be identified in the field or in some cases will need to be identified in a laboratory. A licence will be required to survey for lesser silver water beetles.

Surveys should take place between **February and September**.

Works will need to be timed to cause least disturbance to the species affected. In all cases the extent of the work should be limited and may need to be carried out over several years. Translocation of individuals may be necessary. Note that lesser silver water beetles are fully protected under the Wildlife and Countryside Act from intentional and reckless killing, injury or disturbance. Advice from SCC ecologists should be sought.

8 Enhancement Measures for Biodiversity

A number of measures can be included within highway or RoW schemes to improve local conditions for wildlife either through habitat creation, providing roosting sites and/or easing the effects of habitat fragmentation on animal movement. Each scheme should be considered for its potential to incorporate these measures at a planning stage. Most will be insignificant in terms of cost of the overall scheme, yet have benefits for biodiversity.

8.1 Habitat Creation

Wild flower seed

The specification and sowing of wild flower seed is a simple yet effective way of enhancing habitats for biodiversity, particularly invertebrates. This can be incorporated into most schemes where verge excavation occurs. However, it is important to establish which flora species are appropriate to the location. Proprietary wild flower seed mixes should not be used. A SCC ecologist can specify an appropriate seed mix appropriate to the location. Sub-soils should be used for landscaping, planting and/or sowing. The use of sub-soils also counteracts the nitrogen deposition that occurs alongside roads. In addition, topsoil may contain seeds of competing grasses, thistles, docks and rushes.

Flower swards need to be managed usually by a single cut before or after flowering. A simple regular inspection as part of the maintenance regime could be established to monitor growth and that management is satisfactory.

Seeds should be sourced from a local supplier who can make up the required mix. The Flora Locale website gives the addresses of suppliers local to the County - <http://www.floralocale.org/resources/sources/suppliers.html>

Trees

The planting of native trees and shrubs may enhance the road verge for wildlife. Trees should be of a native species to the location in which they are planted. When planting new trees, consideration should be given to interference with visibility sight lines, detriment to road safety, overhead cables, root damage to the highway infrastructure and having enough room to grow to their full spread. Consideration should be given to other ecological factors, such as hawthorn should not be planted in areas where there are dormouse populations. Berry bushes, such as Hawthorn, should be avoided in areas where there are high bird casualties and or on central reservations. Guidance on species selection, planting and maintenance should be obtained from the County Arborist.

Trees should be sourced locally following Forestry Commission guidelines. In Somerset the parent plant should originate from zones 305 or 404, which zones approximately divide the County north/south
[http://www.forestry.gov.uk/website/pdf.nsf/pdf/provmap.pdf/\\$FILE/provmap.pdf](http://www.forestry.gov.uk/website/pdf.nsf/pdf/provmap.pdf/$FILE/provmap.pdf)

Pond Creation

Opportunities for pond creation should be considered as part of drainage schemes where highway land is available. These will benefit a number of species including frogs, newts and invertebrates such as insects and snails. They may also be used as part of a Sustainable Drainage System. Details of pond construction can be found in '*Ponds, Pools and Lochans*' (2000) published by the Scottish Environmental Protection Agency.

8.2 Sustainable Drainage Systems (SUDS)

SUDS are an alternative to piped drainage systems that uses natural drainage systems to convey and improve the quality of the water discharged from the highway.

These can take the form of filter strips and swales; filter drains and other permeable surfaces; infiltration devices; and basins and ponds.

Where possible, for example, SUDS should be used in preference to piping in highways maintenance. Vegetative systems can be designed to supplement or replace conventional drainage systems. Swales, for example, are wide, shallow and grassed channels located adjacent to the highway, and suited to where roads are on a gently sloping embankment. Infiltration basins can store and treat water and can reduce downstream flooding and pollution. The shape and size of the basin depend on the availability of land. Pond creation is described above.

The planting of reed beds in highway ditches should be considered where appropriate. The planting of whole lengths should be avoided, as this would compromise the survival of some invertebrate species. For further information see <http://www.rspb.org.uk/countryside/managingreserves/habitats/reedbeds/index.asp>

'Sustainable Urban Drainage Systems – Design manual for England and Wales' – published by CIRIA C522 (2001) outlines appropriate design techniques.

8.3 Bird Boxes

It is unlikely that bird boxes installed on or near highway land would be successful. Both Dutch (Reijnen, Veenbass & Foppen, 1995) and Swedish (Helldin & Seiler, 2003) research shows that road traffic generally displaces nesting birds away from highways. However in areas where there is low traffic flow of less than 2000 vehicles per day or along RoW, installation may be successful. Nonetheless, boxes may be erected for some species, such as passerines (for example pied flycatchers and tits) and kestrels along busier roads (Hill, 2001). The use of nest boxes for barn owls should be discouraged near roads however, as their death at night by passing vehicles may be increased.

The type of box erected should be considered in relation to the habitat and the presence of the bird species in the area for which it is intended. Advice can be obtained from a SCC ecologist. Details of nest box construction can be found at: <http://handbooks.btcv.org.uk/handbooks/content/section/1181>

Provision for birds can be made within bridge maintenance and construction on new schemes, by installing bird boxes and by providing holes for nesting and ledges for species such as dippers and grey wagtail.

8.4 Bat Boxes

Bat boxes should be sited where bats are known to feed, but where there are few potential roosts. Woodland rides and glades are ideal, particularly if close to a marsh, pond or river. Woodland edges on roads with low traffic flow would be favourable sites. A check should be made with a SCC ecologist to confirm which species of bat and whether boxes would be useful.

- Place boxes in sheltered and wind-free areas exposed to the sun for part of the day, up to three boxes per tree. An area around the box needs to be cleared to allow bats direct and easy access to the box entrance;

- Most species will use higher positioned boxes (above 4m high), although long-eared bats may use a box 1.5m above the ground;
- Boxes in public areas should consider the possibility of vandalism and of the box being accessible to cats;
- Turning to a safety issue, place the box as high as it is safe to do; and
- Use headless or domed nails not fully hammered home to allow the tree to push the box off without splitting, or strap the box to the tree. Iron nails can be used on trees with no commercial value. Copper nails can be used on conifers, but aluminium alloy nails are less likely to damage saws and chipping machinery.

For details of construction and suppliers see The Bat Conservation Trust website - <http://www.bats.org.uk/batinfo/batboxes.htm>

Once bat boxes are installed, highway's staff should be made aware that it is illegal to disturb bats unless a licence is obtained from Natural England. Boxes can however be monitored by a qualified and licensed person.

8.5 Bat Bricks and Crevices

New roosting sites for bats can be created within structures. These need to be installed during the construction process in order to re-create the thermal capacity, conductivity and microclimates found within the bridge itself. A bat brick consisting of a hollow cube with three open sides is placed within a structure and faced with bat access bricks that have slits permitting entry by bats.

Where opportunities arise to incorporate bat roosting crevices into structures during repairs, these should be taken up. These should be sited within the span of the bridge or as high up an abutment as possible. Examples of how these specialist crevices are constructed can be found in Section 10 of the '*Bat Workers' Manual*' (Mitchell-Jones & McLeish, 2004).

As with bat boxes, a check with a SCC ecologist is necessary before inclusion within the scheme to ensure that species would be potentially present to use it. Sites can only be monitored by a qualified and licensed person.

8.6 Common Dormouse

In areas where dormice are known to be present a number of enhancement measures may aid the local survival of the endangered species. Reference to the Species Alert Mapping through a SCC ecologist would aid identification of areas where dormice are present. The following should be considered:

- The erection of nesting boxes;
- Retention of bramble;
- Planting/re-planting shrub species beneficial to the species, e.g. hazel, oak, honeysuckle, etc., especially where hedgerows have become fragmented;
- Coppicing hazel, etc. where it occurs on highway land. This should be on a long rotational basis with a 7 year minimum between cuts; and

Once nesting boxes have been located highway's staff should be made aware that it is illegal to disturb dormice unless a licence is obtained from Natural England.

8.7 Otter

All watercourses in Somerset are within the range of otters, including small watercourses. Where highway verges are adjacent to a watercourse a number of measures might be incorporated into a scheme.

Where watercourses run parallel to a road, scrub should be planted or encouraged in the verge to discourage otters using the road in times of spate.

Felled trees or rock piles might be left on or near riverbanks to provide shelters, and artificial holts constructed from logs might be considered, but not close to busy roads.

See also Sections 8.10 on underpasses and 8.13 on reflective posts.

8.8 Water Vole

When carrying out drainage operations and during new works there are opportunities for habitat enhancement through restoration of vegetated bankside corridors. Linking existing corridors will help minimise and even reverse local population declines and help the viability of small populations.

Any new ditches created should be profiled so that the banks enable Water Voles to burrow into them. Bank design can be found in '*Water vole mitigation techniques: A questionnaire research project*' (Arnott, 2001)

8.9 Amphibians and Reptiles

Creation of ponds will benefit amphibians and grass snakes. Substitute ponds may be necessary where roads, especially new ones, bisect migratory routes to avoid barrier effects and road casualties. Details of construction can be found in Anderson (1993): *Roads and Nature Conservation*.

Hibernation sites for reptiles may be created on site by the stacking of log piles towards the back of verges. Small piles of rocks and wood can also act as feeding and sheltering sites for some species. Spoil and debris from the maintenance works can be used to create terrestrial habitat.

Small top opening chambers of stone can be constructed within south facing embankments on new works as hibernation sites. This should be used in combination with reptile fencing at the top of the embankment to reduce the risk of road kill. Stones can be left as basking sites for Adders.

Design of winter hibernation sites for Great Crested Newts is given in Natural England's '*Great crested newt mitigation guidelines*' (2001).

Shrub clearance will help provide basking areas where reptile species are known to be present. A range of different habitats benefits reptiles.

8.10 Underpasses for Mammals/Amphibians/Reptiles

Existing roads form a barrier to wildlife and the scale of the barrier increase with the intensity of traffic on a road particularly for invertebrates, amphibians, reptiles and small mammals. Roads with little traffic (below 1,000 vehicles per day) are still permeable to most wildlife; but those with 4,000 to 10,000 vehicles per day impose a strong barrier. Noise and movement will repel many and those that try to cross may become casualties. Roads with over 10,000 vehicles per day are considered to be impermeable to most species (Dufek J, 2001).

Wildlife casualties at 'hotspots' can be minimised by the installation of underpasses. Consideration should also be given to underpasses where wildlife corridors meet the highway, in order to facilitate movement of species across roads. The Environment Officer or the County Ecologist should be consulted on location and specification. In addition to benefits for wildlife benefits may also be obtained through potential reduction in personal injury accidents resulting from wildlife collisions.

Underpasses usually take the form of pipe, culvert or tunnel inserted under the carriageway from one side of the verge to the other. The size of the pipe will vary according to the species that the underpass is intended for and the distance between verges. Underpasses also need to be constructed with fencing to guide the animal to the crossing point and with fencing to prevent the species taking the easy option across the road. Guide specification for amphibians, badgers and otters is given in Appendix 2.

Table 6: Vertebrate Species Known to Use Pipes and/or Culverts/Tunnels as Underpasses (after Anderson, 2002)

Species	Pipes	Culverts/Tunnels
Amphibians	✓	✓
Badger	✓	✓
Bank Vole		✓
Brown Hare		✓
Common Shrew		✓
Fallow Deer		✓
Fox	✓	✓
Hedgehog		✓
Lizards		✓
Mole		✓
Otter	✓	✓
Pygmy Shrew		✓
Red Deer		✓
Roe Deer		✓
Short-tailed Vole		✓
Stoat		✓
Weasel	✓	✓
Wood Mouse		✓

8.11 Invertebrates

After completion of verge work, a number of flat stones can be left lying around. This will provide shelter for species such as ground beetles and centipedes. Log piles in

shady areas will also benefit invertebrate species including Stag Beetles. In locations where Stag Beetles occur (refer to the Species Alert Mapping), artificial breeding boxes of hardwood can be left on site for breeding purposes. Nest sites can be provided for solitary bee and wasp species through the use of drilled blocks of wood, blanked off drainage pipe off cuts or tin cans filled with bamboo canes.

Further measures can be derived from Kirby (1992): '*Habitat Management for Invertebrates: A Practical Handbook*' published by the Royal Society for the Protection of Birds or consult a SCC ecologist.

8.12 Signing

Permanent signing indicating the possible presence wild animals is ineffective, as drivers become used to the sign and pay no heed to it (Bank et al, 2002). Therefore other enhancement measures, such as underpasses or reflective posts detailed below, should be considered. (8.14 for deer)

Where there is a seasonal problem, for instance when common toads migrate across roads to and from breeding ponds then temporary signs may be deployed. Nonetheless, underpasses would give a more permanent solution to the problem.

8.13 Reflective Posts

Reflective posts can be used to help prevent wildlife casualties at 'hotspots' or known crossing places. They deter animals from approaching the road by means of the reflected light. They can be used for species such as deer, otters and badgers. To be successful, regular maintenance is required to prevent vegetation obscuring the reflective surfaces. Verge cutting can also damage the posts and locations need to be identified on verge cutting schedules.

In Somerset reflective posts for otters have been set up on the A361 at Athelney and on the A39 near Holford for deer.

The use of reflective posts for badgers has been tried both in the Netherlands and in the UK. However, there is doubt about their efficiency. Nonetheless, it has been reported that they are very successful in West Sussex where the local badger group manages the posts. Reflective posts need setting up by an expert at night in order to obtain the correct angle of reflection.

The uses of acoustic wildlife warning reflectors have been tried and monitored for effectiveness for deer in Somerset and Hertfordshire during 2005 and 2006 but results have proved inconclusive. For more detail please contact a SCC ecologist.

8.14 Deer Collision Prevention⁶

There is a general risk of Deer Vehicle Collision (DVC) although this is clearly significantly higher in rural, wooded areas where the presence of deer is most likely. As the traffic speed increases so does the potential severity of the collision. Therefore the greatest risk of a severe DVC exists on higher speed roads; roads

⁶ This section is compiled from a study carried out by Hertfordshire County Council

where there is a speed limit above 40mph. Roe deer are widespread through the County and red deer are present on the Quantocks and Exmoor.

The effectiveness of the following measures does vary, but the best results are usually achieved through use of a range of complementary measures, rather than a reliance on any one of the individual measures. Any solution should be tailored to the pattern of accidents observed. Where a hot spot is identified consult a SCC ecologist for advice.

Deer-proof Fencing – Fencing in accordance with the appropriate specification is a well proven method of preventing deer collisions on major roads because the fence stops deer from crossing the road. Deer-proof fencing has been typically installed on new roads, where the risk of deer crossing is an identified risk. The fencing is most successful where it is installed in combination with the construction of ‘green bridges’ and under / overpasses, hence the fencing channels deer to safer crossing points. For fencing of this type to be successful it must form a closed circuit, with particular attention be paid at its ends which must be secure. However, there are many disadvantages to fencing such as cost and impact on biodiversity, such as causing a barrier to animal movement and that if it is crossed by deer the deer is then trapped on the highway, assuming both sides of the road corridor are fenced. This is seldom a suitable solution for retro-fitting to existing roads since the highway boundary on such roads will be frequently punctuated by gates, entrances and other accesses which will prevent the necessary closed circuit from being formed and largely negate the effectiveness of the fencing.

Raised Public Awareness – This is particularly important at the specific time deer are present on the highway. Vehicle Activated (VA) signs can help to achieve this (mentioned below). But raised public awareness can be achieved through education, timely messages and / or campaigns.

Verge Clearance – The clearance of roadside scrub, hedgerows and trees offers two potential advantages. Clear verges removes potential habitat or cover for deer and makes deer more visible for approaching drivers. The benefits of clearance are not established as the driver may still not have sufficient reaction time, due to the speed of both the vehicle and the deer. Clear verges are however a necessity if optical reflectors have already, or are due to be installed.

Vehicle or Deer Actuated Signs – These signs were triggered by either the presence of deer, or by a vehicle exceeding the speed limit. In Hertfordshire anecdotal evidence provided by a National Trust Ranger is that there has been a marked decline in the number of DVC within the vicinity of the signs. However, it should be noted that this was in a specific location and that this was a solution tailored to a known and investigated problem. It is unlikely that VA signs placed generally on the network would have a similar effect.

Speed Limits - A study by Meisingset et al, 2014 highlighted that speed limit reduction coupled with road edge clearance was a powerful mitigation tool to reduce the number of DVCs.

References

- Acts of Parliament. 1959. *Weeds Act 1980*. London: HMSO.
- Acts of Parliament. 1975. *Salmon and Fisheries Act 1975*. London: HMSO.
- Acts of Parliament. 1980. *Highways Act 1980*. London: HMSO.
- Acts of Parliament. 1981. *Wildlife and Countryside Act 1981* (as amended). London: HMSO.
- Acts of Parliament. 1991. *Water Resources Act 1991*. London: HMSO.
- Acts of Parliament. 1992. *Protection of Badgers Act 1992*. London: HMSO.
- Acts of Parliament. 1996. *Wild Mammals (Protection) Act 1996*. London: HMSO.
- Acts of Parliament. 2000. *Countryside and Rights of Way Act 2000* (as amended). London: HMSO.
- Anderson, P. 1994. *Roads and nature conservation: Guidance on impacts, mitigation and enhancement*. Peterborough: Natural England
- Anderson, P. 2002. Roads as barriers. In: Sherwood B, Cutler D & Burton J (eds): *Wildlife and Roads: The Ecological Impact*. London: Imperial College Press.
- Arnott, D. A. 2001. *Water vole mitigation techniques: A questionnaire research project*. Research Report No. 415. Peterborough: Natural England.
- Association of Local Government Ecologists. 2000. *A Biodiversity Guide for the Planning and Development Sectors in the South West*. Exeter: Royal Society for the Protection of Birds.
- Atkins. 2003. *Good Environmental Practice on Site, Issue 2*. Epsom: Atkins.
- Bank, F. G., Leroy, I. C., Evink, G. et al. 2002. *Wildlife Habitat Connectivity Across European Highways*. Washington D.C.: Office of International Programs.
- Bat Conservation Trust. 2012. *Bat Survey Good Practice Guidelines*. London: Bat Conservation Trust.
- Bignal, K., Ashmore, M. & Power, S. 2004. *The ecological effects of diffuse air pollution from road transport*. Peterborough: Natural England.
- Billington, G. 2000. *Radio tracking study of greater horseshoe bats at Mells, Near Frome, Somerset*. Peterborough: English Nature
- Billington, G. E. & Norman, G. M. 1997. *The Conservation of Bats in Bridges Project – A report on the survey and conservation of bat roosts in Cumbria*.
- Boag, D. 1982. *The Kingfisher*. Poole: Blandford Press

- Boyce, D. C. 2004. *A study of the distribution and ecology of the lesser silver water beetle Hydrochara caraboides on the Somerset Levels*. Peterborough: Natural England
- Bright, P. W. & Morris P.A. 2008. Hazel dormouse: in Harris, S. & Yalden, D. W. (eds.) 2008. *Mammals of the British Isles: Handbook 4th Edition*. Southampton: The Mammal Society.
- Bright, P., Morris, P. & Mitchell-Jones, T. 2006. *The dormouse conservation handbook: Second edition*. Peterborough: English Nature
- Brinkmann, R. 2003. *Crossing Points for Bats – Limiting damage of habitat fragmentation by transport projects* Gundelfingen: Wildlife Crossing Points Working Party.
- Büchner, S. 2008. Dispersal of common dormice *Muscardinus avellanarius* in a habitat mosaic. *Acta Theriologica* 53 (3): 259-262
- Byron, H. 2000. *Biodiversity Impact: Biodiversity and Environmental Impact Assessment: A Good Practice Guide for Road Schemes*. Exeter: RSPB, WWF-UK, Natural England and the Wildlife Trusts.
- Chanin, P. 2003. *Ecology of the European Otter Lutra lutra*. Peterborough: English Nature.
- Chanin, P. & Woods, M. 2003. *Surveying dormice using nest tubes: Results and experiences from the South West Dormouse Project*. Peterborough: English Nature.
- Chartered Institute of Ecology and Environmental Management. 2006. *Guidelines for Ecological Impact Assessment in the United Kingdom*. Winchester: CIEEM.
- CIRIA. 2001. *Sustainable Urban Drainage Systems – Design manual for England and Wales*. London: CIRIA.
- Crucitti, P & Cavalletti, L. 2002. Size, dynamics and structure of the lesser horseshoe bat (*Rhinolophus hipposideros*) winter aggregations in central Italy. *Hystrix (n.s.)*, 13, (1-2), (2002), 29-40.
- Department for Environment, Food and Rural Affairs. 2004: *Code of Practice on how to prevent the spread of Ragwort*. London, Defra.
- Department for Environment, Food and Rural Affairs. 2001. *Weeds Act Guidance Notes*. London: Defra. [<http://www.Defra.gov.uk/enviro/weedsact/default.htm>]
- Department for Environment, Food and Rural Affairs 2003. *Technical Advisory Note WM10: Using one-way badger gates on badger sett entrances*. Bristol, Defra.
- Department for Transport 1999. *Roots and Routes: Guidelines on Highways Works & Trees' Draft Consultation Version*. London: DfT [<http://www.roads.dft.gov.uk/consult/roots/index.htm>]
- Dufek, J. 2001. Effects of Infrastructure on Nature: in *How to avoid habitat fragmentation caused by transport infrastructure* [COST 341]. Brussels: European Co-operation in the Field of Scientific and Technical Research.

Duvergé, P. L., Jones, G., Rydell, J. & Ransome, R. D. 2000. Functional significance of emergence timing in bats. *Ecography*, 23, 1, 32–40, February 2000

English Nature.. 1994. *Species Conservation Handbook: Invertebrates 7.3*. Peterborough: Natural England.

English Nature. 1996. *Research Report No.178: The significance of secondary effects from roads and road transport on nature conservation*. Peterborough: Natural England.

English Nature. 1999. *Road verges: in Lowland Grassland Management Handbook*. Peterborough: Natural England.

English Nature. 2001. *Great crested newt mitigation guidelines*. Peterborough, Natural England.

English Nature. 2001. *Water Vole: Guidance for planners & developers*. Peterborough: Natural England.

English Nature. 2002: *Badgers and development*. Peterborough, Natural England.

English Nature. 2003: *The Scrub Management Handbook: Guidance on the management of scrub on nature conservation sites*. Peterborough, Natural England.

Environment Agency. 2003. *Code of practice for the management, destruction and disposal of Japanese knotweed*. Environment Agency.

Evink, G. L. 2002. *Interaction Between Roadways and Wildlife Ecology: A Synthesis of Highway Practice*. Washington D. C.: Transportation Research Board.

Garland, L. 2002. *Microhabitat ecology of small mammals on grassy road verges*. PhD Dissertation - University of Bristol.

Gloucestershire County Council. 2003. *Highways Maintenance Biodiversity Action Plan 2003-2008*.

Gow, D. n/d. *Water vole mitigation guidance - Important updates for evidence-based good practice*.
http://www.watervoles.com/index.htm_files/water%20vole%20mitigation%20guidance.pdf

Grogan, A., Philcox, C. & Macdonald, D. 2001. *Nature Conservation and Roads: Advice in Relation to Otters*. Oxford: Wildlife Conservation Research Unit.

Helldin, J. O. & Seiler, A. 2003. *Effects of roads on the abundance of birds in Swedish forest and farmland*. Riddarhyttan: Swedish University of Agricultural Science.

Hertfordshire County Council. 2013. Draft Strategy for the Control and Mitigation of Deer Encroachment.
<http://www.hertsdirect.org/mm/15520666/15744560/cabinetitem9app1f20140324.pdf>

Highways Agency. 1997-2001. *Design Manual for Roads and Bridges, Volumes 4, 10 & 11*. London: Her Majesty's Stationary Office.

- Highways Agency, 2002. *Highways Agency Biodiversity Action Plan*. London: Highways Agency.
[<http://www.highways.gov.uk/aboutus/corpdocs/biodiversity/index.htm>]
- Hill, D. 2001. *Highways and Birds*. Richmond: Ecoscope Applied Ecologists.
- Holden, P. & Cleeves, T. 2002. *RSPB Handbook of British Birds*. London: Christopher Helm.
- Kirby, P. 1992. *Habitat Management for Invertebrates: A Practical Handbook*. Sandy: Royal Society for the Protection of Birds.
- Kupfer, A. 1998. Wanderstrecken einzelner Kammolche (*Triturus cristatus*) in einem Agrarlebensraum. *Zeitschrift für Feldherpetologie* 5, 238-242.
- Limpens, H. J. G. A. & Kapteyn, K. 1991. Bats, their behaviour, and linear landscape elements. *Myotis* 29: 63-71.
- Limpens, H. J. G. A., Twisk, P. & Veenbans. 2005. *Bats and road construction*. Delft: Rijkswaterstaat, Dienst Weg-en Waterbouwkunde & Arnhem: Vereniging voor Zoogdierkunde en Zoogdierbescherming.
- Macdonald, D. W., Mace, G. & Rushton, S. 1998. *Proposals for future monitoring of British mammals*. London: Department of the Environment, Transport and the Regions.
- Meisingset, E. L., Loe, L. E., Brekkum, O. & Mysterud, A. 2014. Targeting mitigation efforts: The role of speed limit and road edge clearance for deer-vehicle collisions. *The Journal of Wildlife Management*, 78, 4, 679–688, May 2014
- Mitchell-Jones, A.J., & McLeish, A.P. E. 2004. *3rd Edition Bat Workers Manual*. Peterborough: Joint Nature Conservation Committee
- Outen, A. 2002. The ecological effects of road lighting. In: Sherwood B, Cutler D & Burton J (eds) 2002. *Wildlife and Roads: The Ecological Impact*. London: Imperial College Press.
- Radford, P. 2006. *Local Excavation in the Road over Bridges (i.e. 'trial' holes) – Method Statement to Reduce Risk of Disturbing Bats*. Taunton: Somerset County Council
- Ramsden, D. J. 2004. *Barn Owls and Major Roads: results and recommendations of a 15-year research project*. Ashburton: Barn Owl Trust.
- Reijnen, M. J. S. M., Veenbass, G. & Foppen, R. P. B. 1995. *Predicting the Effects of Motorway Traffic on Breeding Bird Populations*. Netherlands: Ministry of Transport and Public Works, et al.
- Schofield, H., Messenger, J., Birks, J. & Jermyn, D. 2002. *Foraging and Roosting Behaviour of Lesser Horseshoe Bats at Ciliau, Radnor*. Ledbury: The Vincent Wildlife Trust
- Scottish Environmental Protection Agency. 2000. *Ponds, Pools and Lochans*. Stirling: SEPA.

Seiler, A. 2002. Effects of Infrastructure on Nature. In: Trocme, M., Cahill, S., De Vries, J. G., et al (eds) *COST 341 – Habitat Fragmentation due to transportation infrastructure: The European Review*. Luxembourg: Office for the Official Publications of the European Communities.

Sherwood, B., Cutler, D. & Burton, J. (eds) 2002. *Wildlife and Roads: The Ecological Impact*. London: Imperial College Press.

Slater, E. M. 2002. An assessment of wildlife road casualties – the potential discrepancy between numbers counted and numbers killed. *Web Ecology* 3, 33, 33-42.

Somerset Environmental Records Centre. 2004. *Somerset Biodiversity: An assessment of biodiversity of Somerset and its districts compared with the UK*. Wellington: Somerset Environmental Records Centre.

Statutory Instruments 2010 No. 490. *The Conservation of Habitats and Species Regulations 2010*. London: HMSO.

Statutory Instruments 1997 No. 1160. *The Hedgerow Regulations 1997*. London: HMSO.

Statutory Instruments 1999 No. 1892. *Town and Country Planning (Tree) Regulations 1999*. London: HMSO.

Stone, E. L., Jones, G. & Harris, S. 2009. Street Lighting Disturbs Commuting Bats. *Current Biology* 19, 1123–1127, July 14, 2009

Stracham, R. & Moorhouse, T. 2006. *Water Vole Conservation Handbook: Second Edition*. Oxford: Wildlife Conservation Research Unit.

Treweek, J. 1999. *Ecological Impact Assessment*. Oxford: Blackwell Science UK.

White, P. A. & Ernst, M. 2003. *Second Nature: Improving Transportation Without Putting Nature Second*. USA: Defenders of Wildlife/Surface Transportation Policy Project.

Contacts

Ecologist

Larry Burrows, Somerset Ecology Services, Planning Control, Somerset County Council, County Hall, Taunton, TA1 4DY. Tel: 01823 358118. Email: LBurrows@somerset.gov.uk

County Ecologist

Tony Serjeant, Somerset Ecology Services, Planning Control, Somerset County Council, County Hall, Taunton, TA1 4DY. Tel: 01823 358143. Email: AJSerjeant@somerset.gov.uk

County Arborist

Steve Scriven, Somerset County Council, County Hall, Taunton, TA1 4DY. Tel: 01823 357566. Email: SJScriven@somerset.gov.uk

Environment Agency

Environment Agency, Rivers House, East Quay, Bridgwater, TA6 4YS. Tel: 01278 457333. Email:

Somerset Wildlife Trust

Somerset Wildlife Trust, 34 Wellington Road, Taunton, Somerset, TA1 5AW. Tel: 01823 652400 Email: enquiries@somersetwildlife.org

Somerset Environmental Records Centre

Somerset Environmental Records Centre, 34 Wellington Road, Taunton, Somerset, TA1 5AW. Tel: 01823 664450. Email: enquiries@somerc.com

Natural England

Wildlife Licensing Unit, First Floor, Temple Quay House, 2 The Square, Bristol, BS1 6EB. Tel: 0845 6014523

Appendix 1 - Notice and Assent Agreement for SSSIs (Roads & RoW)

In circumstances where highway or RoW works are within or adjacent to SSSIs the standard notice letter below should be used to give notice to Natural England. This will either be done by or in consultation with an ecologist. Somerset County Council must wait 28 days after issuing a notice before it may proceed with works. For full details of the notice procedure please refer to part III of the CRow Act.

Example of Notice Letter for Operations Likely to Damage (also known as Potentially Damaging Operations) in an SSSI

Natural England
Riverside,
Castle Street,
Taunton,
Somerset,
TA1 4AP

Notice under Section 28H of the Countryside and Rights of Way Act 2000 – as amends the Wildlife and Countryside Act 1981, of proposed works (detailed below) within/adjacent to the *[insert SSSI name]* Site of Special Scientific Interest

[Title of plan or project]

[Details of person, department, section of SCC proposing the works]

[Location of the proposed plan or project] (include a location plan or map which shows the relationship of the plan to the SSSI)

[Name of the SSSI]

[Nature/description of the plan or project] (include a brief description of the manner in which the plan or project is proposed to be carried out – engineering details, tools/machinery to be used, ancillary activities such as storage of materials & machinery and the disposal of materials).

[Date of the proposed works and the length of time the work is envisaged to take]

It is understood that the plans will not proceed further until there has been a response from Natural England to this notice.

Appendix 2 - Specification for Animal Underpasses

Bats

The following table lists the size of culvert required by various bat species. Lighting should not be used. Linking to guide in structures is essential. Tunnels can be up to 30 metres long.

Species	Watercourse	Terrestrial
Greater Horseshoe	Size of farm vehicle underpass – little data	
Lesser Horseshoe	Size of farm vehicle underpass – little data	
Daubenton's	1.5m above MWL, 1.5 to 2 metres wide	4.5 m high, 4 to 6 metres wide on land
Brandt's	Largest possible culvert	4.5 m high, 4 to 6 metres wide
Whiskered Natterer's	1.5m above MWL, 3 to 6 metres wide	4.5 m high, 4 to 6 metres wide
Bechstein's Barbastelle	-	4.5 m high, 4 to 6 metres wide
Noctule Serotine Pipistrelle	-	4.5 m high, 4 to 6 metres wide
Brown Long-eared Grey Long-eared	Slightly smaller than 4.5 m high, 4 to 6 metres wide	4.5 m high, 4 to 6 metres wide

Otters

Otter underpasses should be constructed with pipework of the following dimensions dependent on length of tunnel:

- Up to 20 metres long – 600mm internal diameter minimum
- 20 metres to 50 metres long - 900mm internal diameter minimum

The underpass need not be straight or line of sight maintained. It should be kept as short as possible and can be located up the embankment, with the appropriate lead in ditch channel. Locating it up the embankment will increase the otter's awareness that it is associated with a road crossing. The underpass should not fill with water and be watertight. A channel should be dug as a lead in to the tunnel entrances.

The correct lead in to the tunnel is important and guide in fences are recommended to 'funnel' the otter into using it both sides of the road. This should lead out in the form of a 'V'. In this case the new fence running alongside the new ditch would provide one arm of the V although this would mean it would be a misshapen V. If not possible to use a V the fence should run parallel with the road at least 150 metres either side of the tunnel. This may be the case on the west side of the road.

Fences should be weld mesh of 3mm gauge and 37.5mm square not of chain link. Badgers have been known to enlarge and deform chain link so that Otters can pass through. Otters are also capable of climbing chain link up to a height of 2 metres. The fence therefore should be 1500mm high with a 300mm overhang angled out at 45 degrees away from the road and 300mm sunk into the ground. Where jointly used for Badgers as well, the mesh should also be sunk into the ground 500mm as detailed below. A lesser specification may be used in many circumstances. The Environment Officer should be consulted

However, it is essential that fencing is erected both sides of the road; otherwise this could result in trapping the Otter on the carriageway. Otters are capable of squeezing through gaps of 50mm.

Badgers

Badger underpasses have to be located where badger trails cross the road. They should be positioned 100mm above existing ground level, if located within an embankment, and the pipe tunnel should drop slightly after the entrance before continuing level under the road. The pipe should be 600mm diameter preferably of concrete and waterproof. Spreading soil through the pipes will help 'naturalise' the tunnel. There should be at least 300mm of cover above the tunnel entrance and a concrete portal may be formed at this point.

Usually lead in fencing is required. This should be as specified for otter underpasses, although away from the proximity of otters the overhang is not required and the height can be reduced to 1500mm. However, the weld mesh should be sunk in the ground 500mm and returned away from the road 300mm.

Amphibians/Reptiles

Amphibians prefer tunnels that are buried close to the ground surface rather than set deep down an embankment. Amphibians may be killed from surface residues on concrete pipes, therefore polymer concrete pipes should be used. Suppliers are listed in the CJDirectory website - <http://www.cjdirectory.com/product-58033.html>.

The position and size (length and diameter) of underpasses and the angle by which they are approached is critical for amphibians. 300mm high screening fences should be used to guide amphibians towards the tunnel entrance. These should also be one way, i.e. permit movement away from the road but over hang 50mm to prevent movement on to the carriageway. Details of construction can be found in '*Toads on Roads*' (n/d) published by the Fauna & Flora International Preservation Society. Froglife can provide contact details of suppliers of tunnel and fence systems - <http://froglife.hostwith.me.uk/info.htm>