

SILVERTOWN TUNNEL

**Preliminary Environmental
Information Report:
Appendix 9.B**

**Invertebrate Survey
Report**

Commissioned by
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SILVERTOWN TUNNEL

INVERTEBRATE

SURVEY REPORT

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1 INTRODUCTION

1.1 Introductory comments

1.1.1 **Colin Plant Associates (UK)** were commissioned on 28th May 2014 by **Hyder Consulting (UK) Ltd** to undertake an assessment of invertebrate ecology interest at the northern launch/receptor site of the proposed new River Thames tunnel at Silvertown.

1.1.2 The study area, indicated in Map 1, is dominated by roadways and made structures. It extends from the Thames embankment to the Silvertown Way Flyover in one direction and from the Docklands Light Railway Station to the Lower Lea Crossing in the other. The survey area has been divided into six recording compartments, as set out in Map 1.

1.1.3 Much of this artificial environment is of relatively recent origin and its creation has enclosed small parcels of the semi-natural habitat that dominated the area as recently as twenty years ago. These semi-natural zones represented an open mosaic of habitats that had become established on areas of previously developed land and they supported very diverse invertebrate assemblages at that time.

1.2 Terrestrial invertebrate sampling methodology

1.2.1 The present survey seeks to identify those of the enclosed semi-natural habitats that persist and if so, to establish whether or not they maintain an invertebrate interest of consequence. For this purpose, a walkover survey was undertaken on 13th June 2013. Areas identified as having potential invertebrate species interest were defined and sampled.

1.2.2 These areas were subsequently revisited on a range of dates in order to obtain an invertebrate species inventory that was as complete as possible and, as a minimum, representative of the habitats under examination.

1.2.3 Visits were undertaken on 13th June, 4th July, 25th July and 11th August 2014. Three different surveyors, with different specialist skills, were involved in order to maximise the potential for recording different invertebrate groups.

1.2.4 Within the constraints discussed below, terrestrial invertebrate sampling was undertaken by direct observation and by the following active sampling methods:

- **Sweep-netting.** A stout hand-held net is moved vigorously through vegetation to dislodge resting insects. The technique may be used semi-quantitatively by timing the number of sweeps through vegetation of a similar type and counting selected groups of species.
- **Beating trees and bushes.** A cloth tray, held on a folding frame, is positioned below branches of trees or bushes and these are sharply tapped with a stick to dislodge insects. Black or white trays are used depending upon which group of invertebrates has been targeted for search. Insects are collected from the tray using a pooter – a mouth-operated suction device.
- **Suction Sampling** consists of using a converted leaf blower to collect samples from grass and other longer ground vegetation. The sample is then everted into a net bag and the invertebrates removed with a pooter. The advantage of suction sampling is that it catches species, which do

not fly readily or which live in deep vegetation. It is particularly productive for Coleoptera, some Diptera and Arachnida.

- 1.2.5 The use of pitfall traps was considered desirable but was physically impractical. Area A (see Map 1) was physically disturbed and traps were not likely to survive; in areas B and C physical access was at least treacherous and carrying the equipment was not an option; area D was off-limits (railway embankment); area E is vegetation growing through cracks in a concrete substrate; area F presented no suitable open ground for the traps. The open access nature of the area also rendered to notion of malaise trapping equally pointless.

1.3 Survey constraints

- 1.3.1 Knowledge of any *relevant* constraints placed upon invertebrate survey work is crucial to the proper interpretation of data obtained.
- 1.3.2 It is regrettable that access was not permitted to the embankments of the railway line (compartments D), especially the south-facing slope which appears to support a varied flora; species survey here was limited to observations made from outside the fence. This area is likely to support a higher level of invertebrate interest than other compartments identified.
- 1.3.3 The safety issues are likely to outweigh the need to undertake survey here since we are of the opinion that any such survey, if undertaken, would simply confirm the assumption that the embankments have a raised invertebrate interest. Consequently, we advise that the development should proceed as if this has been proven, mitigating as appropriate.
- 1.3.4 Sampling was physically difficult and occasionally dangerous in compartments B and C; these contain water bodies. As a consequence, the wetland/amphibious component of the invertebrate fauna may be less well-surveyed than desirable.
- 1.3.5 Here too, it is likely that overcoming the physical issues of safe access may not be cost-effective. Although the history of these water bodies is inadequately known, they do appear, visually, to be potentially important invertebrate habitats. That interest is unlikely to be sufficient to warrant changes to the scheme provided that losses are adequately and appropriately mitigated in the longer term.
- 1.3.6 Other than this, no significant constraints were placed on the species sampling at this site and we are satisfied, at a professional level, that the data obtained are fully representative of the habitats examined.

2 RESULTS OF TERRESTRIAL INVERTEBRATE SAMPLING

2.1 Overview

2.1.1 A full list of all recorded invertebrate species is presented as Appendix 1. A total of 311 species is listed. These are spread between the six recording compartments as follows:

Compartment	A	B	C	D	E	F
Number of species	251	64	39	18	33	74

2.1.2 The list is annotated with formal National Status codes where these are better than “nationally common”; these status codes are explained in Appendix 2.

2.1.3 The list is also annotated with the primary ecological associations of each species, where known. This allows species associated with saltmarsh, sand dunes or other primary habitat types to be immediately discerned.

2.2 Species of conservation interest

2.2.1 Several categories of invertebrates are of raised significance in an ecological assessment. These categories are explained in Appendix 2 and the corresponding species are now examined along with discussion of whether these species were encountered during the surveys or are likely to be present at the site.

Legally Protected Species

2.2.2 No invertebrate species that are afforded direct legal protection under any UK or European criminal legislation were encountered during the survey; none are at all likely to have been overlooked at this site.

UK Biodiversity Action Plan (UK BAP) Priority Species/Section 42 Species

2.2.3 UK BAP priority species were those that were identified as being the most threatened and requiring conservation action under the UK Biodiversity Action Plan (UK BAP). The original list of UK BAP priority species was created between 1995 and 1999. In 2007, however, a revised list was produced, following a 2-year review of the priority species and habitats lists. Following the review, the list of UK BAP priority species increased from less than 600 to 1150. In total, 123 species no longer met the criteria for selection, and were therefore de-listed.

2.2.4 As a result of devolution, and new country-level and international drivers and requirements, much of the work previously carried out by the UK BAP is now focussed at a country-level rather than a UK-level, and the UK BAP has recently (July 2012) been succeeded by the *UK Post-2010 Biodiversity Framework*. The full list of priority invertebrate species can be viewed at <http://jncc.defra.gov.uk/page-5169>.

2.2.5 The UK list of priority species remains an important reference source and has been used to help draw up statutory lists of priorities in England, Scotland, Wales and Northern Ireland. For England and Wales these statutory lists are presented in *The Natural Environment & Rural Communities Act, 2006*: Section 41. *List of Species of Principal Importance for Conservation of Biological Diversity in*

England and Section 42: List of Species of Principal Importance for Conservation of Biological Diversity in Wales.

- 2.2.6 No such Priority Species are so far recorded in the present survey.
- 2.2.7 It is of ecological relevance that the original list of UK Biodiversity Action Plan Priority Species of moths was divided into two sections. In the first, a total of 81 species are afforded the status of UK BAP Priority Species; none of these is recorded in the surveyed area nor is any likely to be present. However, the second section is a list of 69 species that have declined in population strength by a significant amount in the past 25 years. These were defined as “not yet rare” and were flagged as UK BAP species “**for research only**”. This list has been incorporated into the current priority listing process and these species are now therefore of statutory interest.
- 2.2.8 One such “Research Only” moth species has been recorded at the site; others are likely to be present.

The Cinnabar Moth *Tyria jacobaeae* has distinctive black and yellow-striped caterpillars which feed in the flower-heads of ragwort plants and are familiar to most people. The species is widespread and abundant across southern Britain where the foodplant is a notifiable weed species.

At Silvertown, we saw adults flying in compartment D (railway embankment) and found caterpillars on a ragwort plant growing in a crack in the concrete at the base of a wall in compartment E.

Red Data Book Species

- 2.2.8 Two of the species recorded during the surveys are listed in the British Red Data Books (Shirt, 1987; Bratton, 1991) or have been elevated to the status of Critically Endangered, Endangered, Nationally Vulnerable or Near Threatened (formerly Nationally Rare) by subsequent formal reviews. These are as follows:

Toadflax Brocade Moth (*Calophasia lunula*) was until recent years confined to shingle beaches in Kent and Sussex where it flourished. In the past ten years, however, it has begun to colonise post-industrial sites in northern London and perhaps elsewhere. The substrate conditions on many of these sites mirrors that provided by shingle on the south coast, whilst micro-climate factors are also a consideration. The caterpillars feed on toadflax flowers. On shingle beaches they are traditionally found on native yellow toadflax upon which they are highly camouflaged, but in London the domestic Purple Toadflax is also used.

Caterpillars were found on toadflax in compartments A and E.

The ground bug *Stictopleurus punctatonevrosus* is a large pale greenish-brown bug found in dry open habitats. There were nineteenth century records of this species from Surrey and Sussex, but until recently it was believed to be extinct in Britain. It is now recorded widely in warm open flower rich grassland in the south-east and, perhaps in response to climate change, on post-industrial and other unmanaged and sporadically disturbed habitat. The Endangered status is no longer warranted; a review of the conservation status of several invertebrate groups is currently in progress and the status of this species may be formally reduced to Nationally Local when this is published.

Adults were observed running over the ground in compartment A.

Nationally Scarce Species

- 2.2.9 A total of 17 species recorded during the survey are designated as “Nationally Scarce”.
- 2.1.10 Two of these Nationally Scarce species recorded feature in the former Nationally Notable Na category (see Appendix 2).

The Long-winged Cone-head *Conocephalus discolor* is a cricket with a distinctive high-pitched “song” that was formerly restricted to coastal habitats in the south of England. In recent years it has spread around the coast, including the Thames Estuary in particular, and is also found at some inland sites. It seems to have become fairly prevalent on a number of open mosaic habitats on previously developed land, especially where these also contain damp ditches.

At Silvertown we recorded sub-adults in compartment A.

Platynaspis luteorubra is one of the two myrmecophilous (associated with ants) ladybirds in Britain and is found only to the south-east of a line between the Severn and the Wash, with the Home Counties and the Thames Corridor supporting the larger part of the British population at present. The larvae live underground in nests of the common black ant *Lasius niger*, where they feed on subterranean aphids.

At Silvertown, we recorded this ladybird in compartments A and F.

- 2.2.11 Ten of these Nationally Scarce species recorded feature in the former Nationally Notable Nb category (see Appendix 2).

Webb’s Wainscot moth *Archanara sparganii* is associated with Reedmace (*Typha* spp.) and its caterpillars feed internally inside the stems of the plant where these grow in water. This habit is shared with the larva of the far more widespread and common Bulrush Wainscot (*Nonagria typhae*). The two are separated by their physical alignment, with Webb’s Wainscot feeding by tunnelling upwards and eventually pupating head upwards and Bulrush Wainscot working in a downwards direction. Plant (1993) assigned it to Category 4 (Extremely Local) in the London Area; that category is effectively the historical equivalent of a Biodiversity Action Plan Priority Species. Intensive survey since that date shows that it is in fact expected at sites where reedmace grows in water in the Thames Estuary area of Essex and Kent; it also extends northwards up the valley of the River Lea and into that of the River Stort. Away from here it is scarce in the south-east as the Nationally Scarce status is valid.

We recorded it in the wetland compartment B.

Calamotropha paludella is a pyralid moth that is associated with wetland habitats. The larval stages are associated with reedmace (*Typha* species), feeding on the leaves in autumn and found in the dead stems in springtime. The moth is part of the expected wetland assemblage in south-east England and its absence might signify a problem with the habitat.

We recorded it in the wetland compartments B and C.

The beetle *Demetrias imperialis* is confined to the south and south-east of England where it is associated with wetland. It has been found on several different types of emergent vegetation but is most strongly associated with reeds growing in water.

Adults were swept from reeds in compartment B.

The variegated ladybird *Hippodamia variegata* is associated with sandy habitats, primarily in the south, but has adapted to dry ruderal areas within the urban landscape, possibly assisted by the 'heat-island' effect whereby cities are warmer than the surrounding countryside. This has allowed it to spread northwards, though it is only very local away from the south of the country.

It was found to be common in compartment A.

The Yellow-faced Bee *Hylaeus signatus* is an obligate feeder on the pollen of Weld (*Reseda luteola*). Though formerly restricted to the south-east in approximately Kent and Essex it is currently enjoying a wider distribution and extends north at least to Lincolnshire and inland to the West Midlands. It is expected, in season, wherever the foodplant grows and may no longer warrant its nationally scarce status.

Females were recorded at Weld flowers as the base of a wall in compartment E and in the ruderal area of compartment A.

Lasioglossum malachurum is a solitary bee that occurs in southern England, originally on the coast and inland in Essex and Kent, but currently much more widespread throughout the south-east. It constructs its nest chamber in the ground, apparently preferring substrates with a clay content. Adult pollen requirements are un-recorded in Britain, but flower visits are reported from a variety of species, including various yellow composites (Asteraceae). In recent years it has become a widespread and common species in the south-east of Britain and an as yet unpublished review of status removes it from the list of Nationally Scarce species.

We observed a female nectaring at flowers at the base of the wall in compartment E.

The flea beetle ***Longitarsus dorsalis*** is widespread, but local, in southern England. It has primarily been found on calcareous or sandy soils. Grassland, maritime cliff, limestone quarries, and woodland rides and clearings. It is phytophagous and is strictly associated with ragwort. Regular disturbance, on a rotational basis, may be needed to maintain open conditions.

The beetle was swept from flowers in compartment A.

Roesel's Bush-cricket *Metrioptera roeselii* has, recent years, undergone a very large expansion of range that is almost certainly climate-driven. In most years the insects develop without the ability to fly, but in favourable (hot) summers the females develop winged forms that are able to disperse after mating and establish populations in new areas. In the south-east of England, this cricket is present in considerable abundance in grassland habitats, including set-a-side, field margins, road verges and lightly grazed pastures where there is plenty of vegetation cover. The Nationally Notable status is no longer warranted.

Adults were seen and heard in compartment D.

The weevil *Sibinia primita* is associated with coastal dunes, sand pits and disturbed ground generally, on heathland, possibly calcareous grassland and in gardens. It is restricted to Pearlworts (*Sagina* species), though in Europe it is only reported from the closely-related Sand Spurreys (*Spergularia* species). The larvae probably feed in the fruits of the plant.

A single example was recorded in the suction trap sample from compartment A.

The plant hopper *Trigonocranus emmeae* is widely spread but seldom encountered across most of Europe. It was recently found in Poland for the first time and it is unclear if it had been overlooked or if it was a new arrival; its British Isles status is similar. The ecology is unclear. It is usually found under stones but these are almost always in grassland habitats. It is possible that it is a subterranean root feeder.

Examples were recorded by sweep netting and in the suction trap sample at compartment A.

- 2.2.11 Five more of the recorded species encountered so far are Nationally Scarce species of Diptera in former Nationally Notable N category (see Appendix 2). These are:

The hoverfly *Pipizella virens* is probably associated with root aphids of Umbelliferae, especially white-flowering species on whose flowers adults may be seen feeding. Most records are from the London area and Surrey, but this may be due in part to recording bias. Its range extends northwards to the Midlands but it is very local here and scarcely extends much further north.

We recorded a male at a hogweed flower in compartment A.

The picture-winged fly *Trypeta zoe* is a fairly scarce species that seems to thrive particularly in the eastern sector of London and beyond into the Thames Estuary. This is doubtless a consequence of its foodplant also thriving here: the grubs feed internally in the leaves of Mugwort, leaving a characteristic feeding pattern from which the fly can be readily identified.

We netted adults and found mined Mugwort leaves in compartment A.

Volucella zonaria is another hoverfly that is restricted to the south-east of England, especially the London area and whose larvae feed inside the nests of social wasps, including the Common Wasp and the Hornet. This species is noteworthy as being Britain's largest hoverfly.

Adult females were noted in compartment A.

Campiglossa absinthii is a picture-winged fly that has become widespread, feeding on *Artemisia maritima* and *Artemisia vulgaris*. It is most frequent in the south-east, though its range extends northwards to the Midlands and beyond.

Adults were noted in compartment A.

Chorisops nagatomii is a soldier fly whose life history and biology is largely unclear. It was added to the British list in 1979 and appears to be most frequent in the London area. The autecology of this species is rather poorly known in Britain, but the larvae of the closely related *Chorisops tibialis* are detritivorous. Damp habitats feature prominently, including riverside flood refuse and fen habitat.

Adults were noted in compartment A and a single example in compartment F.

Nationally Local Species

2.2.12 Twenty-three of the recorded species are listed formally as Nationally Local (see Appendix 2). These are listed below with their associations:

Species	Ecological associations	Where found					
		A	B	C	D	E	F
<i>Anaceratagallia ribauti</i>	on the ground amongst grasses in dry places – common in the south-east	x					
<i>Aphthona euphorbiae</i>	widely polyphagous	x		x			x
<i>Aspidapion aeneum</i>	larva feeds inside the stems of <i>Malva sylvestris</i>	x					x
<i>Ceratapion carduorum</i>	Thistles	x					
<i>Ceroxys urticae</i>	decaying litter at the edge of brackish or eutrophic water bodies		x				
<i>Chrysotoxum verralli</i>	grassland with associated scrub	x					
<i>Coccinella undecimpunctata</i>	coastal and heathland habitats, but often wanders from here to other places	x					
<i>Cordylepherus viridis</i>	a common grassland species	x					
<i>Corizus hyoscyami</i>	Stork's-bill at coastal sites, mainly south-western	x					
<i>Cryptocephalus fulvus</i>	possibly on sheep's-sorrel, but adults are found on a variety of flowers	x					
<i>Cryptocephalus hypochaeridis</i>	<i>Hieracium</i> species in base-rich grasslands and ruderal sites	x					
<i>Ectemnius dives</i>	nests in rotten timber	x					
<i>Eupteryx florida</i>	various labiates	x					
<i>Hylaeus annularis</i>	nests in hollow plant stems, such as docks, etc		x			x	
<i>Hylaeus pectoralis</i>	nests in the galls of the fly <i>Lipara lucens</i> on reeds in the dry parts of reed beds		x				
<i>Idaea rusticata</i>	withered leaves of ivy, clematis, <i>Alyssum saxatile</i> , etc	x					
<i>Notiophilus substriatus</i>	open, usually dry habitats especially if there is minimal vegetation	x					
<i>Oedemera lurida</i>	a common grassland species	x	x	x			x
<i>Oplodontha viridula</i>	marshes and pond margins	x	x	x			
<i>Oxycera trilineata</i>	larvae in mosses in the edge of water bodies – preferring moving water	x	x				
<i>Stenocranus major</i>	<i>Phalaris arundinacea</i> in marshy places		x				
<i>Tephritis cometa</i>	larvae gall the flowers of creeping thistle	x					
<i>Xanthogramma pedisequum</i>	larvae feed in ants nests	x				x	

3 DISCUSSION

3.1 Introductory comments

- 3.1.1 The total of 311 species recorded is an acceptable total for a site where the sampling effort has been entirely “active” (sweep netting, suction sampling, etc). Greater totals are usually forthcoming when flight interception traps such as Malaise traps are used, but the open public access to the site(s) precluded the use of such techniques here.
- 3.1.2 The inventory includes two Red Data Book species, though in reality both of these have become widespread and common since the designation was applied. In addition, some 17 of the recorded species are Nationally Scarce. Again, one or two of these may not truly warrant their designation, but the majority probably do and so these species should, as always, be taken as representative of the fauna, rather than being looked at in isolation.
- 3.1.3 Nevertheless, the overall quality of the invertebrate fauna that affects the several separate sites examined appears to fall below expectations. Taking all of the 19 noteworthy species at face value, these represent just 5.7% of the overall assemblage; many sites surveyed in the southern area of Newham over the past ten years or so have typically yielded values in excess of 10% for the noteworthy component.
- 3.1.4 It is probable that this is not an unexpected result, given the visual amenity aspects of the surveyed area. However, attention should always be paid to the small and seemingly insignificant areas that often provide a reservoir of invertebrate interest in an otherwise bleak, urban landscape.

3.2 Individual recording compartments

- 3.2.1 Even the smallest of sites, such as a dusty roadside verge, may contribute at least one species to the overall mosaic of meta-habitat in the local area. An examination of the individual component sites is therefore called for.

3.3 Compartment A – Pylon Site

- 3.3.1 This raised area, accessed by a dirt track from the road, is identified by the presence of an electricity pylon, more or less at its mid-point. It extends along the eastern side of the DLR but is more or less linear, since the ground that falls away to the east it is in use as a vehicle parking zone.
- 3.3.2 The ground is variously composed of a clay-based soil, ballast and other materials and supports areas of ruderal grassland as well as many zones of sparse-vegetation. To the north in particular, scrub and young trees dominate the floral mix.
- 3.3.3 This compartment is a small example of the nationally important Open Mosaic Habitat on Previously Developed Land, and as such any loss is likely to call for appropriate mitigation. We have recorded a total of 251 invertebrates here in 2014; in comparison with the other areas studied at Silvertown this is a high value.

3.4 Compartment B –Pond

- 3.4.1 Although in direct line with the Victoria Dock Cut, discussed below, this pond is of more recent origin and examination of satellite images on the Internet reveals that it was absent prior to 2003.
- 3.4.2 Access was had from the south beneath the DLR Flyover, though the dense vegetation makes movement about the site extremely difficult.
- 3.4.3 The pond margins are overgrown and largely hidden by scrub or else are concealed by emergent reeds and other amphibious vegetation. A total of 64 invertebrate species was recorded by us during 2014.
- 3.4.4 It is probable that this site, albeit artificial, supports a diversity of aquatic and amphibious invertebrates that is of raised interest. As already asserted above, the problems associated with access are likely to outweigh the need to undertake further survey here since we are of the opinion that any such survey would simply confirm the assumption of raised invertebrate interest. Consequently, we advise that the development should proceed as if this is indeed the case, mitigating as appropriate.

3.5 Compartment C – Victoria Dock Cut

- 3.5.1 Access to this remnant of the Victoria Dock Cut involved squeezing through a gap in a fence directly above the point at which it disappears below ground towards the River Thames, and then dropping down about 3 metres to the lower level.
- 3.5.2 The cut is surrounded by dense amphibious vegetation, including reeds and reedmace, admixed with invading terrestrial plant species. The compartment overall lies a few metres below the surface level of adjoining land.
- 3.5.3 Although artificial, the cut has benefitted from the neglect that has inevitably resulted from fencing it to exclude access. As an invertebrate site it may well support remnants of the original Thames Grazing Marsh fauna and we recommend that it should be retained and managed as such.

3.6 Compartment D – DLR embankments

- 3.6.1 The embankments of the railway line (which slope upwards to the tracks that separate them) are evidently herb-rich and have possibly been artificially seeded.
- 3.6.2 Given that access to this area was not possible, we are bound to adopt a cautionary approach. On the basis of distant examination the two embankments appear likely to support a raised invertebrate interest. This will be especially true of the south-facing southern embankment. The actual interest is likely to be extremely high because of the urban setting of the site. Further survey is likely to do no more than simply confirm this assumption and consequently, we advise that the development should proceed as if this is indeed the case, mitigating as appropriate.

3.7 Compartment E – Roadside Verge

- 3.7.1 This area comprises a line of ruderal plants growing discontinuously in cracks in the concrete substrate and along the base of the walls of adjacent buildings.

3.7.2 It is of interest, therefore, that a total of 33 invertebrates was recorded in this severely degraded compartment. We are not minded to recommend that this area is retained, but we would suggest strongly that the loss of this and other areas can be mitigated by even the sparsest of replacement plantings.

3.8 Compartment F – Roundabout Corner

3.8.1 This is a small tree group on the edge of the site adjacent to the roundabout at the eastern end of the Lower Lea Crossing.

3.8.2 Although entirely of secondary origin, this small corner plot generated a list of 74 invertebrate species; some of these reflect the ruderal fauna that persists beneath the trees in places, although others reflect the arboreal habitat.

3.9 Mitigation of losses

3.9.1 A detailed appraisal of mitigation opportunities was not part of the present commission. Nevertheless, some comments are appropriate.

3.9.2 No primary habitats are present in the proposed development area; in general terms it can be stated with confidence that the invertebrate habitats here are entirely man-made.

3.9.3 However, it is widely known that many brownfield habitats support exceptionally diverse assemblages of invertebrates and so losses do indeed require mitigating.

3.9.4 On the other hand, mitigating the loss of a man-made site is considerably easy in comparison with what might be required when a semi-natural habitat is affected. In broad terms, the most appropriate methodology will be like for like habitat creation. Particular consideration should, therefore, be given at the design stage to the insertion of features such as “living roofs” as well as to direct habitat creation at ground level in any areas excavated and then back-filled.

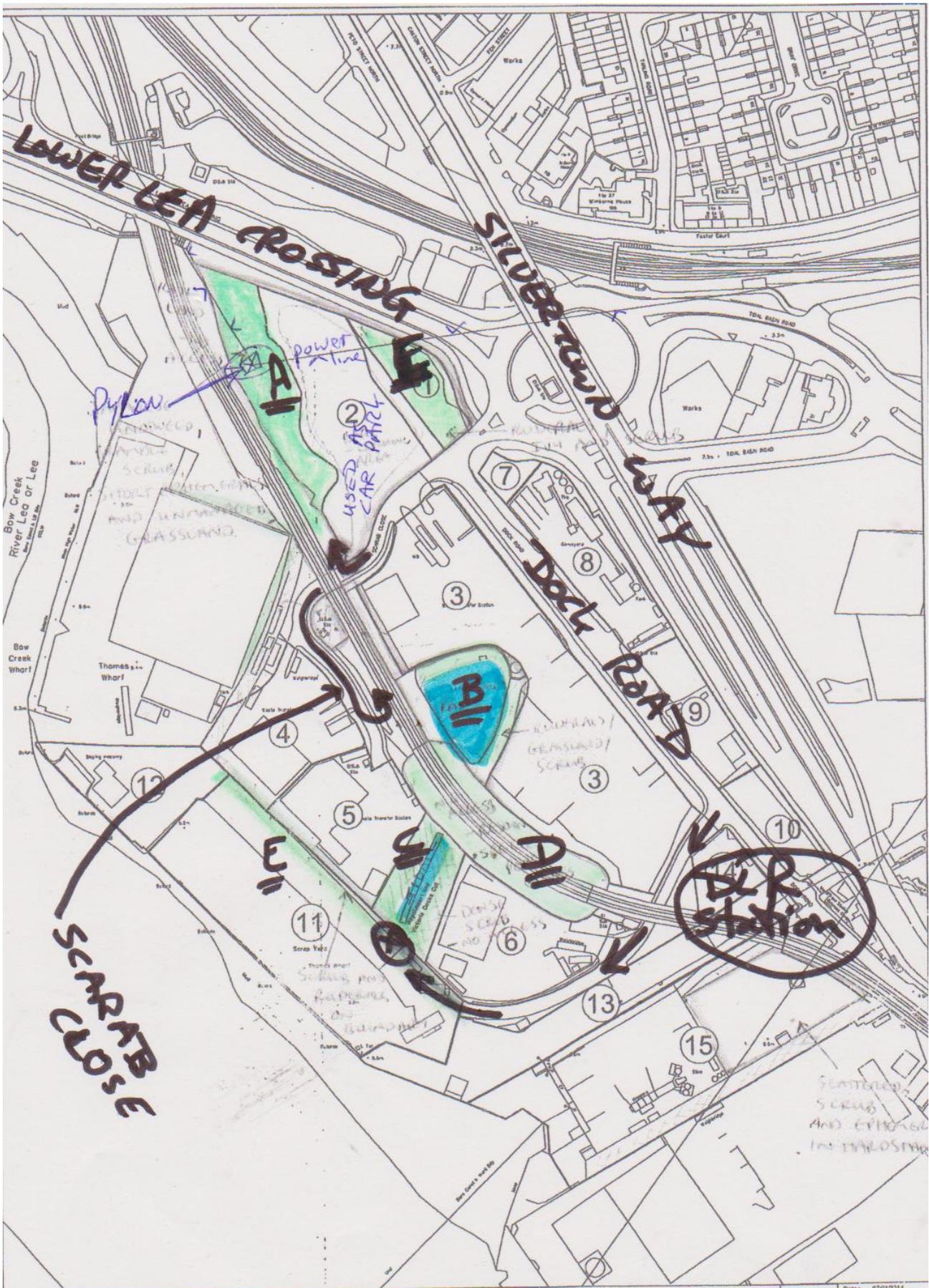
3.9.5 In consideration of the results obtained from Compartment E, the insertion of “green” linear features, no matter how small, is likely to present an overall benefit.

4 REFERENCES USED IN THE CREATION OF THIS REPORT AND ITS APPENDICES

- | | | |
|---------------------------------|------|--|
| Bratton, J. H. | 1991 | <i>British Red Data Books: 3. Invertebrates other than insects.</i> NCC |
| Gwent Wildlife Trust | 2009 | <i>Revisions to selected sections of the Guidelines for the Selection of Wildlife Sites in South Wales to give special regard for Monmouthshire.</i> |
| Hyman, P. S.
& Parsons, M.S. | 1992 | <i>A review of the scarce and threatened Coleoptera of Great Britain Part 1.</i> UK Nature Conservation, number 3 . JNCC. |
| Hyman, P. S.
& Parsons, M. S | 1994 | <i>A review of the scarce and threatened Coleoptera of Great Britain Part 2.</i> UK Nature Conservation, number 12 . JNCC. |
| Lott, D., | 2009 | <i>Synopsis of ISIS 2009 and its use in Common Standards Monitoring.</i> Stenus Research. |
| Shirt, D. B. (ed.) | 1987 | <i>British Red Data Books: 2. Insects.</i> NCC |
| UK Biodiversity Group | 1999 | <i>Tranche 2 action plans. Volume iv - invertebrates.</i> English Nature. |

APPENDICES

MAP 1. THE AREAS SURVEYED IN 2014



APPENDIX 1: TERRESTRIAL INVERTEBRATE SPECIES RECORDED

National status codes are explained in Appendix 2.

Group / species	English name if available	National status	Ecological associations	Where found on site					
				A	B	C	D	E	F
ARACHNIDA: ARANEA	SPIDERS								
Araneidae									
<i>Araneus diadematus</i>	the garden spider		ubiquitous	x					x
<i>Zygiella x-notata</i>			buildings, street furniture and also on bushes but generally synanthropic					x	
Dysderidae									
<i>Dysdera crocata</i>			predatory on woodlice, at night					x	
Linyphiidae									
<i>Lepthyphantes tenuis</i>			ubiquitous - often in grassland, but also a pioneer species		x				x
Salticidae									
<i>Salticus scenicus</i>			usually rests on vertical surfaces such as walls or trees					x	
Thomisidae									
<i>Xysticus cristatus</i>			found in most non-shaded situations					x	
ARACHNIDA: OPILIONES	HARVESTMEN								
Phalangiidae									
<i>Phalangium opilio</i>			under stones or other objects	x	x				x
COLEOPTERA	BEETLES								
Anthicidae									
<i>Anthicus antherinus</i>			larvae in decaying grass litter - adults at flowers	x					
Apionidae									
<i>Apion frumentarium</i>			broad-leaved docks	x					
<i>Aspidapion aeneum</i>		Local	larva feeds inside the stems of <i>Malva sylvestris</i>	x					x
<i>Ceratapion carduorum</i>		Local	Thistles	x					
<i>Ceratapion onopordi</i>			thistles, burdocks, knapweeds and other Compositae	x					
<i>Eutrachapion viciae</i>			<i>Vicia cracca</i> , <i>Lathyrus pratensis</i> and probably other vetches	x					
<i>Ischneroapion loti</i>			<i>Lotus corniculatus</i> and <i>L. tenuis</i> , the larvae galling the seeds	x					
<i>Malvapion malvae</i>			Malvaceae - especially <i>Malva sylvestris</i>	x				x	
<i>Protapion dichroum</i>			<i>Trifolium</i> - widespread and almost ubiquitous	x					
<i>Protapion nigritarse</i>			feeds on a wide variety of low plants and bushes	x	x	x			
<i>Protapion trifolii</i>			various clovers; widespread and common	x					x

Byturidae									
<i>Byturus tomentosus</i>	the raspberry beetle		Brambles and raspberries	x	x	x			x
Cantharidae									
<i>Cantharis cryptica</i>			tall vegetation, especially at the woodland/grassland interface	x	x	x			x
<i>Rhagonycha fulva</i>			tall, rank vegetation in lowland areas	x					
<i>Rhagonycha limbata</i>			dry grasslands	x					
Carabidae									
<i>Agonum dorsalis</i>			grasslands, arable and garden sites - especially on chalky soils	x					
<i>Amara aenea</i>			Phytophagous species of gardens and other open, dry and sunny habitats	x					
<i>Amara communis</i>			phytophagous species of open sites, hiding under leaf rosettes, stones, etc	x					
<i>Amara familiaris</i>			Phytophagous species of gardens and other open, dry and sunny habitats	x					
<i>Amara ovata</i>			most open on moderately dry ground	x					
<i>Amara aulica</i>			dry, well-vegetated sites, the adults climbing stems of Compositae at night to feed on the seed heads	x					
<i>Badister bullatus</i>			ubiquitous	x					
<i>Bembidion quadrimaculatum</i>			open sunny sites, arable fields, sparsely-vegetated ground, often near water	x					
<i>Calathus fuscipes</i>			widespread and common species of dry open ground	x	x				
<i>Calathus melanocephalus</i>			dry grasslands, dry ruderal sites and similar	x					
<i>Demetrias imperialis</i>		NS(Nb)	Tall wetland vegetation, especially reeds		x				
<i>Dromius melanocephalus</i>			litter, mosses, grassland - especially at coastal sites	x					
<i>Harpalus rufipes</i>			ubiquitous	x					
<i>Microlestes minutulus</i>			known from scattered localities in south-east Britain	x					
<i>Nebria brevicollis</i>			ubiquitous late summer and autumn species	x					
<i>Notiophilus biguttatus</i>			most open ground habitats	x					
<i>Notiophilus substriatus</i>		Local	open, usually dry habitats especially if there is minimal vegetation	x					
<i>Pterostichus madidus</i>			ubiquitous	x					
Chrysomelidae									
<i>Aphthona euphorbiae</i>		Local	widely polyphagous	x		x			x
<i>Bruchus rufimanus</i>	Broad Bean Weevil		larva on Vicia (vetches); adults at flowers	x					
<i>Cassida rubiginosa</i>			various thistles, burdock and other Asteraceae	x					
<i>Cryptocephalus fulvus</i>		Local	possibly on sheep's-	x					

			sorrel, but adults are found on a variety of flowers							
<i>Cryptocephalus hypochaeridis</i>		Local	<i>Hieracium</i> species in base-rich grasslands and ruderal sites	x						
<i>Longitarsus dorsalis</i>		NS(Nb)	Ragworts (<i>Senecio</i> species) - a southern species	x						
<i>Longitarsus luridus</i>			widely polyphagous	x						
<i>Oulema melanopa</i>			feeds on grasses - very common	x						
<i>Phyllotreta nigripes</i>			various Brassicaceae	x						
<i>Phyllotreta undulata</i>			various Brassicaceae	x						
<i>Sphaeroderma rubidum</i>			feeds on thistles and other Asteraceae	x						
Coccinellidae										
<i>Adalia bipunctata</i>	2-spot ladybird		predatory on other insects	x						
<i>Adalia decempunctata</i>	10-spot ladybird		predatory on other insects	x						
<i>Anisostica novemdecimpunctata</i>	19-spot ladybird		wetland habitats		x	x				
<i>Coccidula rufa</i>	Spotless ladybird		reed beds and other marshy places		x					
<i>Coccinella septempunctata</i>	7-spot ladybird		predatory on other insects	x						
<i>Coccinella undecimpunctata</i>	11-spot ladybird	Local	coastal and heathland habitats, but often wanders from here to other places	x						
<i>Harmonia axyridis</i>	Harlequin ladybird		a recent colonist in Britain	x	x	x	x	x	x	x
<i>Hippodamia variegata</i>	variegated ladybird	NS(Nb)	ruderal or sandy habitats	x						
<i>Platynaspis luteorubra</i>		NS(Na)	larvae are aphidiphagous in nests of the ant <i>Lasius niger</i>	x						x
<i>Propylea quatuordecimpunctata</i>	14-spot ladybird		predatory on other insects	x	x	x				x
<i>Psyllobora vigintiduopunctata</i>	22-spot ladybird		feeds on mildews	x		x				
<i>Rhyzobius litura</i>			predatory on other insects	x	x					
<i>Subcoccinella vigintiquatuorpunctata</i>	24-spot ladybird		predatory on other insects	x		x				
Cryptophagidae										
<i>Telmatophilus typhae</i>			a reed bed species		x					
Curculionidae										
<i>Ceutorhynchus obstrictus</i>			various Cruciferae	x						
<i>Glocianus distinctus</i>			grasslands, field margins and similar laces	x						
<i>Mecinus pascuorum</i>			feeds on flowers of <i>Plantago lanceolata</i> (Ribwort Plantain)	x						
<i>Phyllobius pyri</i>			Larvae develop in the ground an adults feed on a variety of herbage and tree leaves	x						x
<i>Sibinia primitus</i>		NS(Nb)	dry sandy areas - frequently coastal, perhaps on <i>Spergularia</i>	x						
<i>Sitona lineatus</i>			various legumes	x	x	x				x

Dasytidae										
<i>Dasytes plumbeus</i>			larvae in dead wood; adults feed on pollen at flowers	x						x
Dermestidae										
<i>Anthrenus verbasci</i>			feeds on dead animal and plant matter, including dry carcasses	x						x
Kateretidae										
<i>Brachypterus glaber</i>			Nettles	x	x					x
<i>Brachypterus urticae</i>			Nettles	x	x					x
Leiodidae										
<i>Catops nigricans</i>			carrion							x
<i>Sciodrepoides watsoni</i>			decaying litter and carrion						x	
Malachiidae										
<i>Axinotarsus marginalis</i>			predatory species, found mainly at flowers	x						
<i>Cordylepherus viridis</i>		Local	a common grassland species	x						
<i>Malachius bipustulatus</i>			grasslands	x						
Nitidulidae										
<i>Meligethes aeneus</i>			various flowers	x	x	x			x	x
Oedemeridae										
<i>Oedemera lurida</i>		Local	a common grassland species	x	x	x				x
<i>Oedemera nobilis</i>			a common grassland species	x	x	x	x			x
Phalacridae										
<i>Olibrus affinis</i>			associated with the capitula of various Compositae	x						
Staphylinidae										
<i>Aleochara curtula</i>			leaf litter, decaying vegetation etc	x						
<i>Aloconota gregaria</i>			plant litter - ubiquitous	x						
<i>Anotylus sculpturatus</i>			grass tussocks, litter, dung etc	x						
<i>Atheta aequatica</i>			a detritus-feeding rove beetle	x						
<i>Atheta fungi</i>			a detritus-feeding rove beetle	x						
<i>Drusilla canaliculata</i>			litter, moss, under stones etc - a predator of ants	x						
<i>Gyrohypnus fracticornis</i>			a detritus-feeding rove beetle	x						
<i>Lathrobium brunnipes</i>			grass tussocks, litter, dung etc	x						
<i>Ocypus ater</i>			carrion, dung, etc	x						
<i>Paederus littoralis</i>			on mud at water margins. Local in the north	x						
<i>Philonthus longicornis</i>			a detritus-feeding rove beetle	x						
<i>Quedius levicollis</i>			leaf litter, carrion, dung and similar	x						
<i>Quedius schatzmayri</i>			leaf litter and other plant debris	x						
<i>Stenus boops</i>			wet habitats, especially pond margins	x						
<i>Stenus juno</i>			a common species in wet	x						

			habitats						
<i>Stenus solutus</i>			wet habitats generally	x					
<i>Tachinus rufipes</i>			amongst grass litter, in tussocks, etc	x					
<i>Xantholinus longiventris</i>			leaf litter, grass tussocks and similar micro-habitats - very common	x					
Tenebrionidae									
<i>Lagria hirta</i>			dry sandy habitats and also in many urban brownfield sites	x					x
CRUSTACEA	WOODLICE								
Armadillidiidae									
<i>Armadillidium vulgare</i>	the pill bug		under stones etc	x					
Oniscidae									
<i>Oniscus asellus</i>			damp, but not wet, habitats everywhere	x	x	x		x	x
Philosciidae									
<i>Philoscia muscorum</i>			under stones etc	x	x				x
Platyarthridae									
<i>Platyarthrus hoffmanseggi</i>			lives inside the nests of ants, usually <i>Lasius niger</i>	x					
Porcellionidae									
<i>Porcellio scaber</i>			under stones etc	x		x			x
DERMAPTERA	EARWIGS								
Forficulidae									
<i>Forficula auricularia</i>			generalist species	x	x	x		x	x
DIPTERA	TRUE FLIES								
Anthomyiidae									
<i>Pegomya solennis</i>			larva mines the leaves of dock plants	x				x	
Asilidae									
<i>Leptogaster cylindrica</i>			grassland predator	x	x				
Bibionidae									
<i>Dilophus febrilis</i>			associated with dung	x					x
Calliphoridae									
<i>Calliphora vicina</i>			dung or dead bodies	x					
<i>Lipara lucens</i>			forms a cigar-shaped gall on reed stems		x				
Culicidae									
<i>Culex pipiens</i>			freshwater to breed; adult bites birds and mammals including humans		x				
Empididae									
<i>Empis (Kritempis) livida</i>			predatory on other flies	x			x	x	
Fanniidae									
<i>Fannia armata</i>			decaying organic matter						x
<i>Fannia serena</i>			decaying organic matter						x
<i>Fannia similis</i>			decaying organic matter						x
Lonchopteridae									
<i>Lonchoptera bifurcata</i>			a more or less ubiquitous species in edge habitats	x					x
Scathophagidae									
<i>Scathophaga litorea</i>			animal dung	x					x
<i>Scathophaga stercoraria</i>			animal dung	x					
Sepsidae									
<i>Sepsis cynipsea</i>			Larvae feed in animal					x	
<i>Sepsis orthocnemis</i>			larvae feed in dung,					x	x
<i>Themira annulipes</i>			damp habitats, especially						

			on organically enriched soils						
Stratiomyidae									
<i>Beris chalybata</i>			associated with the scrub/grassland interface	x					
<i>Beris vallata</i>			saprophagous larvae	x	x	x			
<i>Chloromyia formosa</i>			ubiquitous	x	x	x	x	x	
<i>Chorisops nagatomii</i>		NS (N)	biology unknown - fairly common in East London/Essex	x					x
<i>Chorisops tibialis</i>			saprophagous larvae	x	x				
<i>Microchrysa polita</i>			larvae require decomposing organic matter	x					
<i>Oplodontha viridula</i>		Local	marshes and pond margins	x	x	x			
<i>Oxycera trilineata</i>		Local	larvae in mosses in the edge of water bodies - preferring moving water	x	x				
<i>Pachygaster atra</i>			woodland edge & scrubland species - larvae under dead bark of trees	x	x	x			x
<i>Pachygaster leachii</i>			woodland edge & scrubland species - larvae under dead bark of trees	x	x	x			x
Syrphidae									
<i>Cheilosia pagana</i>			larvae are thought to feed in the roots of <i>Anthriscus sylvestris</i>	x					x
<i>Cheilosia proxima</i>			larvae feed in the roots of <i>Cirsium</i> species of thistle, especially <i>Cirsium palustre</i>	x					
<i>Chrysotoxum bicinctum</i>			grassland species - associated with ants' nests	x					x
<i>Chrysotoxum verralli</i>		Local	grassland with associated scrub	x					
<i>Epistrophe eligans</i>			mainly at edge habitats	x	x			x	
<i>Episyrphus balteatus</i>			ubiquitous species, partly immigrant, and a predator of aphids	x			x	x	x
<i>Eristalis arbustorum</i>			Larvae require damp habitats but adults are more or less ubiquitous	x					
<i>Eristalis pertinax</i>			Larvae require damp habitats but adults are more or less ubiquitous	x					
<i>Eristalis tenax</i>			Larvae require damp habitats but adults are more or less ubiquitous	x					x
<i>Eupeodes corollae</i>			Grassland	x					
<i>Eupeodes luniger</i>			Grassland	x					
<i>Helophilus pendulus</i>			larvae feed in wet organic matter, possibly in association with <i>Typha</i>	x	x				
<i>Melanostoma mellinum</i>			Grassland	x					
<i>Myathropa florea</i>			larvae are semi-aquatic	x					
<i>Neoascia podagrica</i>			edge-habitat species	x					x
<i>Neoascia tenur</i>			reeds and similar emergent vegetation		x	x			

<i>Paragus haemorrhous</i>			bare or sparsely vegetated, dry sandy ground	x					
<i>Pipizella viduata</i>			Larvae feed on root aphids on Umbelliferae	x					
<i>Pipizella virens</i>		NS(N)	probably associated with root aphids of Umbelliferae	x					
<i>Platycheirus albimanus</i>			ubiquitous - larvae prey on aphids	x					
<i>Platycheirus clypeatus</i>			Damp habitats		x	x			
<i>Platycheirus fulviventris</i>			larvae feed on the aphid <i>Hyalopterus pruni</i> on monocotyledonous plants in wetlands		x				
<i>Platycheirus peltatus</i>			aphid predator		x				
<i>Platycheirus scutatus</i>			an edge-habitat species	x					
<i>Sphaerophoria rueppellii</i>			coastal grasslands	x					
<i>Sphaerophoria scripta</i>			Grassland - larvae prey on aphids	x			x	x	
<i>Syritta pipiens</i>			larvae in decaying vegetation; adults at flowers	x					
<i>Syrphus vitripennis</i>			larvae are aphid predators on trees and bushes	x					
<i>Tropidia scita</i>			reed beds in wetland areas		x				
<i>Volucella zonaria</i>		NS(N)	inquiline in nests of social wasps/hornet	x					
<i>Xanthogramma pedisequum</i>		Local	larvae feed in ants nests	x				x	
Tachinidae									
<i>Eriothrix rufomaculata</i>			larva parasitises moth larvae	x					
Tephritidae									
<i>Campiglossa absinthii</i>		NS (N)	has become widespread, feeding on <i>Artemisia maritima</i> and <i>A. vulgaris</i>	x					
<i>Euleia heraclei</i>			larvae feed in the seed heads of white-flowering Umbelliferae	x					
<i>Tephritis cometa</i>		Local	larvae gall the flowers of creeping thistle	x					
<i>Terellia ruficauda</i>			larvae gall the flowers of thistles	x					
<i>Terellia serratae</i>			larvae gall the flowers of thistles	x					
<i>Trypeta zoë</i>		NS(N)	larva mines leaves of mugwort	x					
<i>Urophora cardui</i>			larvae gall the flowers of thistles						x
Therevidae									
<i>Thereva nobilitata</i>			biology uncertain	x					
Tipulidae									
<i>Nephrotoma flavipalpis</i>			hedges and other wooded edge habitats	x					
<i>Nephrotoma quadrifaria</i>			common in woodlands, also in hedgerows, scrub and similar	x					
<i>Tipula oleracea</i>			ubiquitous, larvae feeding	x	x	x			x

			on roots of grasses						
<i>Tipula paludosa</i>			ubiquitous, larvae feeding on roots of grasses	x					x
Ulidiidae									
<i>Ceroxys urticae</i>		Local	decaying litter at the edge of brackish or eutrophic water bodies		x				
<i>Melieria omissa</i>			decaying vegetation at the edge of water bodies or in damp sites		x				
EPHEMEROPTERA	MAYFLIES								
Baetidae									
<i>Cloeon dipterum</i>			Running and still water - on submerged plants		x	x			
HETEROPTERA	TRUE BUGS								
Anthocoridae									
<i>Anthocoris nemoralis</i>			trees and bushes		x	x			x
<i>Anthocoris nemorum</i>			low vegetation	x					
<i>Orius niger</i>			low vegetation on a variety of dry sites	x					
<i>Orius vicina</i>			predatory amongst low growing vegetation	x					
Coreidae									
<i>Coreus marginatus</i>			Develops on a variety of Polygonaceae in open habitats	x					
<i>Syromastus rhombeus</i>			feeds on Polygonum species in ruderal and other open sites	x					
Lygaeidae									
<i>Chilacis typhae</i>			Reedmace - in the flower heads		x				
<i>Drymus brunneus</i>			amongst litter or moss in damp or shaded places			x			
<i>Heterogaster urticae</i>			Nettles	x					
<i>Kleidocerys resedae</i>			trees and shrubs generally		x	x			x
<i>Nysius ericae</i>			in ruderal habitats	x					x
<i>Scolopostethus thomsoni</i>			usually on nettles						x
Miridae									
<i>Adelphocoris lineolatus</i>			leguminous plants	x					
<i>Closterostomus norvegicus</i>			polyphagous	x					
<i>Deraeocoris ruber</i>			nettles, brambles and similar rough vegetation	x	x	x			x
<i>Europiella artemisiae</i>			Mugwort - probably wherever this grows	x					x
<i>Heterotoma planicornis</i>			edge habitats - especially in association with nettles	x					x
<i>Liocoris tripustulatus</i>			stinging nettle	x					
<i>Lopus decolor</i>			open grasslands, especially dry calcareous ones but also colonises ruderal sites	x					
<i>Lygocoris pabulinus</i>			Polyphagous amongst low vegetation	x					
<i>Lygus maritimus</i>			Chenopodiaceae - in coastal sites and inland ruderal sites	x					
<i>Lygus rugulipennis</i>			polyphagous - especially common in ruderal	x					

			communities						
<i>Notostira elongata</i>			grasslands	x					
<i>Orthocephalus saltator</i>			dry habitats with areas of open, un-vegetated ground	x					
<i>Orthops kalmii</i>			on various umbelliferous flowers	x					
<i>Phytocoris varipes</i>			dry, open grasslands are preferred. Partly vegetarian and partly a predator	x					
<i>Plagiognathus arbustorum</i>			polyphagous, but usually associated with stinging nettles	x					
<i>Plagiognathus chrysanthemi</i>			polyphagous	x					
<i>Stenodema calcarata</i>			grasslands	x					
<i>Stenodema laevigata</i>			grasslands	x					
Nabidae									
<i>Himacerus mirmicoides</i>			ground dwelling predator of dry, open areas	x					
<i>Nabis ferus</i>			dry sites, especially ruderal grassland	x					
Pentatomidae									
<i>Aelia acuminata</i>			Thistles	x					x
<i>Dolycoris baccarum</i>			polyphagous species of dry habitats	x					
<i>Eurydema oleracea</i>			feeds on cruciferous plants	x					
<i>Eysarcoris venutissimus</i>			probably polyphagous	x					
<i>Nezara viridula</i>			a recent colonist of southern England from Europe	x					
<i>Palomena prasina</i>			trees and shrubs		x	x			x
<i>Podops inuncta</i>	the Turtle Bug		dry places, especially ruderal sites. A markedly southern species	x					
Rhopalidae									
<i>Corizus hyoscyami</i>		Local	Stork's-bill at coastal sites, mainly south-western	x					
<i>Stictopleurus punctatonervosus</i>		Ext	Formerly considered extinct, now recolonising ruderal habitat on brownfield sites in the south-east	x					
HOMOPTERA: AUCHENORHYNCHA		FROGHOPPERS AND PLANT HOPPERS							
Aphrophoridae									
<i>Aphrophora alni</i>			trees and bushes		x	x			x
<i>Neophilaenus campestris</i>			dry, open grassland	x					
<i>Philaenus spumarius</i>	spittle-bug		larvae feed under froth on a wide range of herbaceous plants	x					x
Cicadellidae									
<i>Anaceratagallia ribauti</i>		Local	on the ground amongst grasses in dry places - common in the south-east	x					
<i>Aphrodes makarovi</i>			on nettles, thistles and	x					

			other plants in grasslands						
<i>Cicadella viridis</i>			grasses and rushes in marshy places	xx					
<i>Eupteryx aurata</i>			low growing plants	x					
<i>Eupteryx florida</i>		Local	various labiates	x					
<i>Eupteryx urticae</i>			Usually on nettles	x				x	
<i>Euscelis incisus</i>			grasses	x					
<i>Psammotettix confinis</i>			grasses, including on post-industrial sites	x					
Cixiidae									
<i>Trigonocranus emmeae</i>		NS(Nb)	ecology unclear - usually found under stones	x					
Delphacidae									
<i>Stenocranus major</i>		Local	<i>Phalaris arundinacea</i> in marshy places		x				
HOMOPTERA: PSYLLOIDEA	PLANT LICE								
Triozidae									
<i>Triozia urticae</i>			stinging nettle	x					x
HYMENOPTERA: ACULEATA	BEEES, WASPS AND ANTS								
Apidae									
<i>Apis mellifera</i>	honey bee		flowers in general	x			x	x	x
<i>Bombus lapidarius</i>	red-tailed bumble bee		ubiquitous						x
<i>Bombus lucorum</i>	white-tailed bumble bee		ubiquitous				x		
<i>Bombus pascuorum</i>	common carder bee		ubiquitous				x	x	
<i>Bombus terrestris</i>	buff-tailed bumble bee		ubiquitous	x					
<i>Hylaeus annularis</i>	a yellow-faced bee	Local	nests in hollow plant stems, such as docks, etc		x				x
<i>Hylaeus pectoralis</i>		Local	nests in the galls of the fly <i>Lipara lucens</i> on reeds in the dry parts of reed beds		x				
<i>Hylaeus signatus</i>		NS(Nb)	requires pollen from <i>Reseda</i> - nests in hollow plant stems	x					x
<i>Lasioglossum albipes</i>			ground-nesting solitary bee of ruderal habitats				x		
<i>Lasioglossum malachurum</i>		NS(Nb)	ground nesting species - prefers soils with a clay component						x
<i>Lasioglossum smeathmanellum</i>			excavates nest burrows in level ground	x					x
<i>Megachile willughbiella</i>			nests in plant stems or other cavities				x		
Formicidae									
<i>Lasius niger</i>	common black ant.		generalist species	x					x
<i>Myrmica rubra</i>	a red ant		ubiquitous	x					
Sphecidae									
<i>Ectemnius dives</i>		Local	nests in rotten timber	x					
Vespidae									
<i>Vespa germanica</i>			ubiquitous	x					x
HYMENOPTERA: SYMPHYTA	SAWFLIES								
Cepidae									
<i>Cephus cultratus</i>			larvae mine the stems of grasses	x					
Tenthredinidae									
<i>Athalia bicolor</i>			ubiquitous sawfly species		x				

<i>Athalia cordata</i>			ubiquitous sawfly species			x			
<i>Athalia rosae</i>			phytophagous species			x			
LEPIDOPTERA:	BUTTERFLIES								
Hesperiidae									
<i>Ochlodes faunus</i>	Large skipper		grassland				x		
<i>Thymelicus lineola</i>	Essex skipper		grassland	x					
Lycaenidae									
<i>Celastrina argiolus</i>	Holly blue		both holly and ivy are required - as there are two generations per year						x
Nymphalidae									
<i>Inachis io</i>	Peacock		nettles	x			x		
<i>Maniola jurina</i>	Meadow brown		grassland species	x					
<i>Pararge aegeria</i>	Speckled wood		grasses in light woodland or scrub	x					
<i>Pyronia tithonus</i>	Gatekeeper		larvae feed on coarse grasses	x			x		
<i>Vanessa atalanta</i>	Red admiral		most often recorded as an immigrant from overseas	x			x		
Pieridae									
<i>Colias croceus</i>	Clouded Yellow		only known in Britain as a primary immigrant				x		
<i>Pieris brassicae</i>	Large white		various Cruciferae	x				x	
<i>Pieris napi</i>	Green-veined white		ubiquitous						x
<i>Pieris rapae</i>	Small white		ubiquitous						x
LEPIDOPTERA:	MOTHS								
Arctiidae									
<i>Thumatha senex</i>	Round-winged Muslin		lichens and mosses		x				
<i>Tyria jacobaeae</i>	Cinnabar	BAP(R)	Ragworts				x	x	
Choreutidae									
<i>Anthophila fabriciana</i>	Nettle-tap		nettles						x
Coleophoridae									
<i>Coleophora alcyonipennella</i>			clovers	x					
Cosmopterigidae									
<i>Limnaecia phragmitella</i>			larva in seed heads of reed-mace, causing the head to disintegrate	x	x				
Geometridae									
<i>Idaea aversata</i>	Riband wave		herbaceous plants - especially bedstraws				x		
<i>Idaea rusticata</i>	Least Carpet	Local	withered leaves of ivy, clematis, Alyssum saxatile, etc	x					
Lasiocampidae									
<i>Euthrix potatoria</i>	Drinker		grasses, including reeds		x				
<i>Euproctis similis</i>	Yellow-tail		deciduous trees and shrubs						x
Lyonetiidae									
<i>Lyonetia clerkella</i>			mines leaves of rosaceous bushes and trees, birch etc						x
Momphidae									
<i>Mompha subbistrigella</i>			<i>Epilobium montanum</i> - in the seed pod	x					
Nepticulidae									
<i>Stigmella aurella</i>			mines leaves of bramble	x					x
Noctuidae									
<i>Archanara sparganii</i>	Webb's Wainscot	NS(Nb)	Typha - in the stems		x				

<i>Calophasia lunula</i>	Toadflax Brocade	R RDB3	Feeds on toadflax flowers - a recent colonist of the London Area	x					x
<i>Rivula sericealis</i>	Straw Dot		grasses - especially <i>Brachypodium</i> species	x		x			
<i>Xestia c-nigrum</i>	Setaceous Hebrew Character		herbaceous plants	x					
Oecophoridae									
<i>Hofmannophila pseudospretella</i>			detritus, birds' nests, etc						x
Pterophoridae									
<i>Emmelina monodactyla s.str.</i>			bindweed	x		x			
Pyralidae									
<i>Agriphila straminella</i>			grasses	x					x
<i>Agriphila tristella</i>			grasses	x					
<i>Calamotropha paludella</i>		NS(Nb)	reedmace (<i>Typha</i>) - leaves in autumn & dead stems in spring		x	x			
<i>Chrysoteuchia culmella</i>			grasses	x					x
<i>Crambus lathoniellus</i>			grasses	x					
<i>Crambus pascuella</i>			grasses	x					
<i>Udea ferrugalis</i>			immigrant from overseas - also breeds on herbaceous plants but dies in winter	x					
Tortricidae									
<i>Aethes tesserana</i>			feeds in the roots of <i>Picris</i> , <i>Hieracium</i> , <i>Crepis</i> and <i>Inula</i>	x					
Zygaenidae									
<i>Zygaena filipendulae</i>	Six-spot Burnet		<i>Lotus</i> , especially <i>corniculatus</i>				x		
MECOPTERA									
SCORPION FLIES									
Panorpidae									
<i>Panorpa germanica</i>			edge habitats	x	x				x
NEUROPTERA									
LACEWINGS									
Chrysopidae									
<i>Chrysoperla carnea</i>			aphid predator of trees and bushes	x				x	x
Hemerobiidae									
<i>Hemerobius lutescens</i>			trees and bushes, hedges, etc						x
<i>Micromus paganus</i>			ubiquitous, but usually in association with wood or scrub						x
ODONATA									
DRAGONFLIES AND DAMSELFLIES									
Coenagriidae									
<i>Enallagma cyathigerum</i>					x				
<i>Ischnura elegans</i>	Blue-tailed damselfly		found in most permanent water bodies, the adults flying from May to August		x				
Libellulidae									
<i>Libellula depressa</i>	Broad-bodied Chaser		water-bodies with abundant emergent vegetation	x	x				
<i>Sympetrum striolatum</i>					x				

ORTHOPTERA	GRASSHOPPERS AND CRICKETS								
Acrididae									
<i>Chorthippus brunneus</i>	Field grasshopper		grassland	x					x
<i>Chorthippus parallelus</i>	Meadow grasshopper		grassland	x					
Tettigoniidae									
<i>Conocephalus discolor</i>	Long-winged Cone-head	NS(Na)	coarse vegetation on the coast - recently it has colonised inland sites	x					
<i>Leptophyes punctatissima</i>	Speckled Bush-cricket		rough herbage and scrub				x		x
<i>Metriopectera roeselii</i>	Roesel's Bush-cricket	NS(Nb)	long grassland				x		

APPENDIX 2: INVERTEBRATE STATUS CODES

Earlier published reviews of scarce and threatened invertebrates employed the Red Data Book criteria used in the British Insect Red Data Book (Shirt 1987) with the addition of the category RDBK (Insufficiently Known) after in 1983. In addition, the status category Nationally Notable (now termed Nationally Scarce) was used from 1991. The original criteria of the International Union for the Conservation of Nature (IUCN – now called the World Conservation Union) for assigning threat status used in these publications had the categories *Endangered*, *Vulnerable*, and *Rare*, which were defined rather loosely and without quantitative parameters. The application of these categories was largely a matter of subjective judgment, and it was not easy to apply them consistently within a taxonomic group or to make comparisons between groups of different organisms. The deficiencies of the old system were recognised internationally, and in the mid-1980s proposals were made to replace it with a new approach which could be more objectively and consistently applied. In 1989, the IUCN's Species Survival Commission Steering Committee requested that a new set of criteria be developed to provide an objective framework for the classification of species according to their extinction risk. The first, provisional, outline of the new system was published in 1991. This was followed by a series of revisions, and the final version adopted as the global standard by the IUCN Council in December 1994. The guidelines were recommended for use also at the national level. In 1995, the Joint Nature Conservation Committee (JNCC) endorsed their use as the new national standard for Great Britain, and subsequent British Red Data Books have used these revised IUCN criteria. These criteria are used in this present report and are as follows:

EXTINCT (EX) A species is *Extinct* when there is no reasonable doubt that the last individual has died.

EXTINCT IN THE WILD A species is *Extinct* in the wild when it is known to survive only in cultivation, in captivity or as a naturalised population (or populations) well outside the past range.

CRITICALLY ENDANGERED

A species is *Critically Endangered* when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the following criteria:

A. Population reduction in the form of either of the following:

1. An observed, estimated, inferred or suspected reduction of at least 80% over the last 10 years or three generations, whichever is the longer, based on direct observation, an index of abundance appropriate for the species, a decline in area of occupancy, extent of occurrence and/or quality of habitat, actual or potential levels of exploitation or the effects of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.
2. A reduction of at least 80%, projected or suspected to be met within the 10 years or three generations, whichever is the longer, based any of these parameters.

B. Extent of occurrence estimated to be less than 100 Km² or areas of occupancy estimated to be less than 10 Km² and estimates indicating any two of the following:

1. Severely fragmented or known to exist at only a single location.
2. Continuing decline, observed, inferred or projected, in any of the following: a. extent of occurrence b. area of occupancy c. area, extent and/or quality of habitat d. number of locations or sub-populations e. number of mature individuals
3. Extreme fluctuations in extent of occurrence, area of occupancy, number of locations or sub-populations or number of mature individuals.

C. Population estimated to number less than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within 3 years or one generation, whichever is longer or
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either severely fragmented (*i.e.* no sub-population estimated to contain more than 50 mature individuals) or all individuals are in a single sub-population

D. British population estimated to number less than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild of at least 50% within 10 years or 3 generations, whichever is the longer.

ENDANGERED (Formerly RDB category 1)

A species is Endangered when it is not *Critically Endangered* but is facing a very high risk of extinction in the wild in the near future, as defined by any of the following criteria:

A. Population reduction in the form of either of the following:

1. An observed, estimated, inferred or suspected reduction of at least 50% over the last 10 years or three generations, whichever is the longer, based on direct observation, an index of abundance appropriate for the species, a decline in area of occupancy, extent of occurrence and/or quality of habitat, actual or potential levels of exploitation or the effects of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.
2. A reduction of at least 50%, projected or suspected to be met within the 10 years or three generations, whichever is the longer, based any of these parameters.

B. Extent of occurrence estimated to be less than 5,000 Km² or areas of occupancy estimated to be less than 10 Km² and estimates indicating any two of the following:

1. Severely fragmented or known to exist at no more than five locations.
2. Continuing decline, observed, inferred or projected, in extent of occurrence, area of occupancy, area, extent and/or quality of habitat, number of locations or sub-populations or the number of mature individuals.

C. Population estimated to number less than 2500 mature individuals and either:

1. An estimated continuing decline of at least 20% within 5 years or 2 generations, whichever is longer or
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either severely fragmented (*i.e.* no sub-population estimated to contain more than 250 mature individuals) or all individuals are in a single sub-population

D. British population estimated to number less than 250 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild of at least 20% within 20 years or 5 generations, whichever is the longer..

VULNERABLE (Formerly RDB category 2)

A species is *Vulnerable* when it is not *Critically Endangered* or *Endangered* but is facing a high risk of extinction in the wild in the medium-term future, as defined by any of the following criteria (A to E):

A. Population reduction in the form of either of the following:

1. An observed, estimated, inferred or suspected reduction of at least 20% over the last 10 years or three generations, whichever is the longer, based on direct observation, an index of abundance appropriate for the species, a decline in area of occupancy, extent of occurrence and/or quality of habitat, actual or potential levels of exploitation or the effects of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.
2. A reduction of at least 20%, projected or suspected to be met within the 10 years or three generations, whichever is the longer, based any of these parameters.

B. Extent of occurrence estimated to be less than 20,000 Km² or areas of occupancy estimated to be less than 20,000 Km² and estimates indicating any two of the following:

1. Severely fragmented or known to exist at no more than ten locations. Continuing decline, observed, inferred or projected, in extent of occurrence, area of occupancy, area, extent and/or quality of habitat, number of locations or sub-populations or the number of mature individuals.
2. Extreme fluctuations in extent of occurrence, area of occupancy, number of locations or sub-populations or number of mature individuals.

C. Population estimated to number less than 10,000 mature individuals and either:

1. An estimated continuing decline of at least 10% within 10 years or 3 generations, whichever is longer or
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either severely fragmented (*i.e.* no sub-population estimated to contain more than 1000 mature individuals) or all individuals are in a single sub-population

D. Population very small or restricted in the form of either of the following:

1. Population estimated to number less than 1,000 mature individuals.
2. Population is characterised by an acute restriction in its area of occupancy (typically less than 100 km) or in the number of locations (typically less than 5). Such a species would thus be prone to the effects of human activities (or stochastic events whose impact is increased by human activities) within a very short period of time in an unforeseeable future, and is thus capable of becoming *Critically Endangered* or even *Extinct* in a very short period.

E. Quantitative analysis showing the probability of extinction in the wild of at least 10% within 100 years.

LOWER RISK (Formerly RDB category 3)

A species is Lower Risk when it has been evaluated but does not satisfy the criteria for any of the categories *Critically Endangered*, *Endangered* or *Vulnerable*. Species included in the Lower Risk category can be separated into three sub-categories:

- **Conservation Dependent** species which are the focus of a continuing species -specific or habitat-specific conservation program targeted towards the species in question, the cessation of which would result in the species qualifying for one of the threatened categories above within a period of five years.