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The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) (Amendment) Scheme 201-

The London to Fishguard Trunk Road (East of Magor to Castleton) Order 201-

The M4 Motorway (West of Magor to East of Castleton) and the A48(M) Motorway (West of Castleton to St Mellons)(Variation of Various Schemes) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and The London to Fishguard Trunk Road (east of Magor to Castleton) (Side Roads) Order 201-

The Welsh Ministers (The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and the London to Fishguard Trunk Road (East of Magor to Castleton)) Compulsory Purchase Order 201-

The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) (Supplementary) Scheme 201-

The Welsh Ministers (The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) and The London to Fishguard Trunk Road (East of Magor to Castleton)) Supplementary Compulsory Purchase Order 201-

Proof of Evidence

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Welsh Government, Bats

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1. Introduction And Scope Of Evidence

1.1 Personal details

- 1.1.1 My name is Richard Austin Green and I am owner and Director at Richard Green Ecology Ltd (RGEL). I hold a BSc Honours Degree in Applied Biology, specialising in Ecology. I am a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and a Chartered Environmentalist with the Society for the Environment.
- 1.1.2 I have been a professional ecologist since completing my BSc Honours Degree in 1993. From 1993 until 2001 I was a Conservation Officer for the National Rivers Authority and subsequently Environment Agency.
- 1.1.3 In 2001, I joined Halcrow Group Ltd (HGL) as an Ecological Consultant, becoming a Principal Ecologist and having responsibility for leading a team of environmental scientists from several disciplines in 2006.
- 1.1.4 During my time with HGL I worked for the Highways Agency (HA), both as a seconded assistant environmental advisor for HA Areas 1 & 2 (for 3 years) and as lead ecologist for a research and development project on bats and highways (for 3 years). This project resulted in the production of a Design Manual for Roads and Bridges (DMRB) Interim Advice Note on bats (IAN 116/08). I also undertook an ecological impact assessment for Welsh Assembly Government on the A487(T) Porthmadog, Minffordd and Tremadog Bypass Scheme and co-ordinated a Habitats Regulations Assessment of the Welsh National Transport Plan.
- 1.1.5 In 2010, I left HGL to set up Richard Green Ecology Ltd (RGEL). In my current role as Director of RGEL, I continue to undertake ecological survey and assessment, specialising in bats. In 2010, RGEL was subcontracted to CH2M Hill (Halcrow) to undertake a review of bat mitigation in relation to highway severance for the HA, resulting in a published report in 2011.
- 1.1.6 Since 2011 I have been working for RPS and Costain undertaking environmental assessment and mitigation design for bats in relation to

improvements to Section 2 (Gilwern to Brynmawr) of the A465 Heads of the Valleys Road. This is a very challenging Scheme, part of which passes through the Usk Bat Sites Special Area of Conservation (designated in part for lesser horseshoe bats). Survey and mitigation for bats on this Scheme has been extensive and innovative.

- 1.1.7 My Proof of Evidence is concerned with the environmental assessment, Scheme design and mitigation elements of the proposed M4CaN Scheme (hereinafter “the Scheme”) in relation to bats.
- 1.1.8 Dr Keith Jones has provided Proof of Evidence on other ecological matters, including details of ecological designations and policies.
- 1.1.9 Parts of my Proof of Evidence are based on surveys carried out by others, including ecologists employed by RPS and other consultancies, including Arup and Thomson Ecology. I was involved with the project at the 2015 survey scoping stage and had meetings with Arup and RPS ecologists to agree appropriate survey methods, subsequently agreed with NRW. I have confidence in the bat survey methodologies and having read the survey reports, had discussions with those responsible for that work, and ‘walked over’ the site with RPS ecologists who undertook bat surveys, I have confidence in and accept their findings. The Proof of Evidence I will give is based on my own conclusions regarding the potential effects of the Scheme on bats and has been prepared in accordance with CIEEM’s Code of Professional Conduct. I confirm that the opinions expressed are given in a fair and impartial manner and are my true and professional bona fide opinions.

1.2 Scope and Structure of this Evidence

- 1.2.1 Mr Matthew Jones explains in his Proof of Evidence [WG 1.1.1] the process of option selection and Mr Ben Sibert explains Scheme design in his Proof of Evidence [WG 1.5.1].
- 1.2.2 Dr Keith Jones, in his Proof of Evidence [WG 1.18.1], sets out the ecological and nature conservation considerations that informed the

Scheme development subsequent to the award by the Welsh Government of the Professional Services contract for the Scheme development and environmental surveys, including publication of Draft Statutory Orders, and up to the Public Local Inquiry.

- 1.2.3 My Proof of Evidence is concerned with the predicted effects on bats resulting from the construction and operation of the Scheme.
- 1.2.4 Bats are the only true flying mammals and there are currently 18 species known to be resident in the UK, of which 16 species are found in Wales. All British bats are insectivorous and rely mainly on habitats that provide a large biomass of insects, such as woodland, trees and hedgerows, wetland and unimproved pastures, for feeding.
- 1.2.5 Bats are long-lived and have a complex social life and a number of unusual biological and behavioural features. They have developed a highly sophisticated echolocation system that allows them to avoid obstacles and catch tiny insects in complete darkness. However, bats struggle to detect traffic travelling at speeds consistent with motorway traffic and are therefore at risk of mortality when flying over such roads.
- 1.2.6 Within their range, bats require different seasonal roosts and foraging habitats, as well as connecting habitat corridors. Mobility and migration ranges differ between species and seasons. Heavily pregnant and lactating bats tend to forage close to maternity roosts in summer because of the increased energy demands at this time. Similarly, bats may emerge and forage close to hibernation roosts during the winter. Brown long-eared bats have a relatively small range, with migration rarely observed over 30 km and most foraging activity observed within 2 km of maternity roosts. Common pipistrelle bats and lesser horseshoe bats have an annual range of up to 20 km. A short-term range of 2-3 km is 'normal' for foraging lesser horseshoe bats, whilst heavily pregnant females may confine their foraging to within 1 km of maternity roosts. Other bats, including Nathusius' pipistrelle, noctule and Leisler's can migrate over hundreds of kilometres.

- Summer range and location of maternity roosts is closely connected with availability of favourable foraging habitat.
- 1.2.7 Bats roost in buildings, bridges, trees and underground structures/features and tend to use linear landscape elements, such as tree-lines or hedges, for commuting between roosts and foraging areas. These linear habitats can also provide an important foraging resource in their own right and individual bats will repeatedly fly ‘up and down’ sections of such features during their nightly foraging activity.
- 1.2.8 Bats hibernate to conserve energy during the winter months when their insect food is in short supply. Hibernation roosts (hibernacula) may be in caves, underground and other structures, buildings or trees, where there is low temperature variation and a high relative humidity. Bats may hibernate singly, or many bats may use the same roost site.
- 1.2.9 Female bats tend to be colonial during the summer months, congregating at maternity roosts mostly in trees or buildings to give birth, usually to only one young. For this reason bat population numbers do not increase rapidly, unlike other small mammal species, such as rodents.
- 1.2.10 Bat numbers are considered to have dramatically declined since the mid-20th Century due to the loss of roost sites, loss of feeding habitat, habitat fragmentation, use of pesticides and direct persecution and are still vulnerable to human activities, including construction and operation of roads. Despite this, bats are widespread and occur in rural and urban situations. Monitoring of bat species since 1999, coordinated by the Bat Conservation Trust, has shown an increase in British bat species populations of all species monitored except serotine bat.
- 1.2.11 Eight species are listed under Section 42 of the Natural Environment and Rural Communities (NERC) Act 2006 [Document 3.1.13] as of principal importance for the conservation of biodiversity in Wales. These include barbastelle bat, Bechstein’s bat, noctule bat, common and soprano pipistrelle bats, brown long-eared bat, lesser and greater horseshoe bats.

- 1.2.12 The Welsh Government Trunk Road Estate Biodiversity Action Plan (TREBAP) 2004-2014 [Document 6.1.1] and the Newport Local BAP [Document 11.2.30] both contain a species action plan for bats.
- 1.2.13 Statutory designated nature conservation sites within the Scheme study area are shown on March 2016 ES Figures 10.1 (International Statutory Sites) and 10.2 (National Statutory Sites) [Document 2.3.2]. These include the Wye Valley and Forest of Dean Bat Sites/Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC, designated for lesser horseshoe and greater horseshoe bats.
- 1.2.14 This SAC comprises a complex of sites on the border between England and Wales containing the greatest concentration of lesser horseshoe bats in the UK, equivalent to approximately 26% of the national population. The complex also represents the northern part of the range for greater horseshoe bats and supports approximately 6% of the UK population. The sites contain maternity bat roosts, as well as suitable hibernation habitat in disused mines.
- 1.2.15 The SAC includes four SSSIs, of which two are within the study area: Mwyngloddfa Mynydd-Bach SSSI and Wye Valley Lesser Horseshoe Bat SSSI.
- 1.2.16 Mwyngloddfa Mynydd-Bach SSSI provides lesser horseshoe bat hibernation habitat in disused mines. It is located 6.2 km to the north east of the Scheme extent (a haul road to Ifton Quarry) or 9 km to the north east of Magor Interchange (Junction 23A; Figure 1 of this Proof of Evidence), where the new road starts (refer to Figure 1). Wye Valley Lesser Horseshoe Bat SSSI contains a summer nursery roost for lesser horseshoe bats and is located 7.4 km from the Scheme extent (the haul road to Ifton Quarry) or over 10 km to the north east of Magor Interchange. These SSSIs are not well connected to the Scheme by woodland habitat, and a number of roads exist between the SSSI and the Scheme, including the A48 and existing M4.

- 1.2.17 All bat species and their roosts are protected under the Conservation of Habitats and Species Regulations 2010 [Document 3.1.22] and are also protected under the Wildlife and Countryside Act 1981 (as amended) [Document 3.1.7], through inclusion in Schedule 5, and under the Countryside and Rights of Way Act 2000 [Document 3.1.12].
- 1.2.18 Under the Conservation of Habitats and Species Regulations 2010 it is illegal to deliberately disturb bats. In particular, any disturbance which is likely (a) to impair their ability to survive, to breed or reproduce, to rear or nurture their young, or to hibernate or migrate, or (b) to affect significantly the local distribution or abundance of the species to which they belong is an offence under Regulation 41.
- 1.2.19 Taken together, these acts and regulations make it illegal to:
- a) intentionally or deliberately kill, injure or capture bats;
 - b) deliberately or recklessly disturb bats;
 - c) damage, destroy or obstruct access to places of shelter, breeding sites or resting places used by bats;
 - d) have in one's possession or control, any live or dead bat; and
 - e) sell, barter or exchange bats, or parts of bats.
- 1.2.20 As several bat roosts will be destroyed during construction of the Scheme, a derogation licence will be required from Natural Resources Wales (NRW). As part of a licence application, a method statement is required that sets out the details of the roosts to be affected and the proposed mitigation and monitoring. To grant a licence, NRW must consider that the following three tests under the Conservation of Habitats and Species Regulations 2010 will be satisfied.
- a) Regulation 53(2)(e) states that licences may be granted to “preserve public health or public safety or other imperative reasons of overriding

public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment.”

- b) Regulation 53(9)(a) states that a licence may not be granted unless “there is no satisfactory alternative”.
- c) Regulation 53(9)(b) states that a licence cannot be issued unless the action proposed “will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range”.

1.2.21 My Proof of Evidence is presented in the following structure:

- a) Introduction and Scope of Evidence
- b) Methodology and Consultation
- c) Baseline Conditions
- d) Potential Impacts of the Scheme on Bats
- e) Mitigation for Bats
- f) Residual Effects of the Scheme on Bats
- g) Consultees' Responses and Objections to the Scheme
- h) Summary and Conclusions
- i) Figures

2. Methodology and Consultation

2.1 Methodology

- 2.1.1 Bat surveys have been undertaken since 2014 to inform the development and provide a baseline for assessment of the Scheme. An account of surveys undertaken is contained in Chapter 10 of the March 2016 ES in paragraphs 10.3.43 to 10.3.58 [Document 2.3.2], in paragraphs 4.6.49 to 4.6.58 of the September 2016 ES Supplement [Document 2.4.4] and paragraphs 4.4.7 to 4.4.11 of the December 2016 ES Supplement [Document 2.4.14]. Assessment followed relevant guidance, listed in paragraph 10.3.1 of the March 2016 ES [Document 2.3.2].
- 2.1.2 Bat surveys for the Scheme were carried out on behalf of the Welsh Government in 2014 by or for Arup and consisted of bat roost potential assessments of buildings and trees, walked bat activity transect surveys and static bat activity monitoring along the route where access permission was granted. Survey methods and locations of transects and static monitoring were agreed with NRW. In addition, a desk study of bat records within the study area was undertaken (report published as Appendix 10.7 of the March 2016 ES [Document 2.3.2])
- 2.1.3 Further desk study, bat activity and bat roost surveys were carried out in 2015 by RPS (or sub consultants commissioned by RPS) to further inform the assessment of the Scheme.
- 2.1.4 Following guidance in DMRB Volume 10 Section 4 Part 3 HA 80/99 'Nature Conservation Advice in Relation to Bats' [Document 6.1.8] the desk study was based on data within 5 km of the Scheme provided by the South East Wales Biological Records Centre (SEWBRc).
- 2.1.5 Two types of bat activity surveys were undertaken in 2015; a survey of bat activity at fifty linear features which would be crossed by the new section of motorway (primarily hedgerows and tree belts along reens and ditches) using static detectors; and manned dusk and dawn surveys at seven underpasses and bridges crossing the existing M4 motorway.

- 2.1.6 Further bat hibernation roost surveys and bat emergence surveys were completed in 2016 in order to supplement the previous surveys.
- 2.1.7 The Bat Hibernation Roost Survey report was appended to the September 2016ES Supplement [Document 2.4.4]. The ‘Bat Roost Surveys of Buildings and Structures 2016’ and ‘2016 Bat Surveys’, which contains further tree surveys, comprise Appendices SS10.3 and SS10.2 of the December 2016 ES Supplement [Document 2.4.14].
- 2.1.8 The bat surveys undertaken in 2015 and 2016 were agreed with NRW.
- 2.1.9 In conjunction with the ES, an Assessment of Impacts on European Sites (AIES) has been carried out following guidance in DMRB HD44/09 to fulfil the requirements of the Conservation of Habitats and Species Regulations 2010 in relation to potential effects on European sites, including the Wye Valley and Forest of Dean Bat Sites Special Area of Conservation (SAC), which includes lesser horseshoe bat and greater horseshoe bat as qualifying features. This was reported on separately in the Statement to inform an Appropriate Assessment (SIAA) [Document 2.3.4].

2.2 Consultation

- 2.2.1 The full process of consultation during the development of the Scheme is summarised in the Proof of Evidence of Mr Matthew Jones [WG 1.1.1]. Dr Keith Jones also summarises consultation in relation to ecology and nature conservation in his Proof of Evidence [WG 1.18.1].
- 2.2.2 Comments relating to ecology and nature conservation in the EIA Scoping Report (March 2016 ES Appendix 5.1) [Document 2.3.2] were received from NRW and Newport City Council. NRW welcomed the level of surveys undertaken and noted that further surveys were being undertaken to further inform the ES. NRW did not request any additional surveys.
- 2.2.3 NRW were also consulted and agreed to the scope of additional bat surveys necessary to inform the EIA in January 2015 at a meeting with Hyder Consulting (the Employer’s Agent, now incorporated into Arcadis)

(Appendix 9.1 of the ES Scoping Report, which is in Appendix 5.1 of the March 2016 ES) [Document 2.32]. Regular (monthly) meetings have also been held with NRW throughout the development of the proposals.

3. Baseline Conditions

3.1 Desk study data

- 3.1.1 The desk study identified records of a total of 13 bat species within 5 km of the Scheme. These were; Daubenton's bat *Myotis daubentonii*; whiskered bat *M. mystacinus*; Brandt's bat *M. brandtii*; Natterer's bat *M. nattereri*; serotine *Eptesicus serotinus*; Leisler's bat *Nyctalus leisleri*; noctule bat *N. noctula*; Nathusius's pipistrelle *Pipistrellus nathusii*; common pipistrelle *P. pipistrellus*; soprano pipistrelle *P. pygmaeus*; brown long-eared bat *Plecotus auritus*; greater horseshoe bat *Rhinolophus ferrumequinum*; and lesser horseshoe bat *R. hipposideros*.
- 3.1.2 Bat records were widespread across the study area but with the greatest concentration in the western half. Many records were in clusters at locations in Cardiff, Marshfield, Ruperra Woodlands and Park Wood, Rogerstone, Cwmbran, Newport, Newport Wetlands Reserve, Llanbedr, Wentwood Reservoir, Magor Marsh and Caldicot.
- 3.1.3 Common pipistrelle and noctule bat were recorded on the edge of the Scheme corridor near the River Usk at Newport Docks. Common pipistrelle, noctule, soprano pipistrelle and unidentified bats were recorded near the Scheme corridor around Magor.
- 3.1.4 Common pipistrelle was the most frequently recorded species and was recorded across the search area.

3.2 Bat activity survey findings

- 3.2.1 The most commonly recorded species during both the 2014 and 2015 bat activity surveys was common pipistrelle, with soprano pipistrelles and *Myotis* species also frequently detected.
- 3.2.2 In addition to the bats identified in the desk study, low numbers of barbastelle bat *Barbastella barbastellus* passes were recorded during surveys in 2014 and 2015 along the Scheme route in small numbers from a cluster of records around Magor in the east to Lighthouse Road in the west.

The maximum average barbastelle bat activity (0.4 bat passes per night in 2014) was along the east side of the A4180, just to the south of the M4, west of Magor. The second highest average barbastelle bat activity (0.3 bat passes per night in 2015) was along the east side of the A4180, just to the north of the South Wales Mainline railway. All other locations where barbastelle bat was recorded had average bat passes per night of 0.1 or less.

- 3.2.3 Surveys confirmed that woodland and areas comprising tree-lined lanes and watercourses were found to have the highest levels of bat activity within the study area.
- 3.2.4 Lesser horseshoe bats were recorded at eight of the 20 locations where static monitoring was undertaken in 2014. These were all located to the east of the River Usk between Pye Corner and the eastern end of the study area. Lesser horseshoe bats were only recorded in the areas around Magor and Llandeenny in 2015, with levels of activity in this area generally comparable with those observed in 2014.
- 3.2.5 When considering data from both 2014 and 2015, the maximum average lesser horseshoe bat activity (2.5 bat passes per night) was recorded at Mill Reen underpass (referred to as St Bride's Brook underpass in Appendix 10.23 of the March 2016 ES [Document 2.3.2]). All locations where between 1 and 2 average lesser horseshoe bat passes per night were recorded were located along the east side of the A4180, between the M4 and just to the south of the South Wales Mainline railway. All other locations where lesser horseshoe bats were recorded had average bat passes per night of less than one.
- 3.2.6 A single greater horseshoe bat was recorded on one occasion in 2014, to the east of Whitecross Farm/west of River Ebbw at chainage 7750.
- 3.2.7 The diversity of bat species recorded was consistently higher (in 2014 and 2015) at the eastern end of the proposed new section of motorway around Llandeenny and Magor than the western end.

- 3.2.8 The areas from Berryhill Farm to Maerdy Farm in the west, around the East Usk Railway, and immediately south of the existing M4 Magor interchange (Junction 23A) had relatively high levels of Myotis bat species, probably due to the existing roadside and rail side woodland planting in those areas.
- 3.2.9 Bat activity surveys of underpasses and bridges crossing the existing M4 demonstrated that Mill Reen underpass and the road underpasses at St Brides Road, The Elms and Bencroft Lane (all at the Magor end of the new section of motorway) were regularly used by commuting bats. Small numbers of lesser horseshoe bats were recorded flying through Mill Reen underpass in all months but June between April and October 2014. An unusually high activity index of 11 passes per night was recorded in April 2014, with 4.4 passes per night recorded in September 2014, and one or less passes per night in May, July, August and October 2014. No lesser horseshoe bats were recorded at Mill Reen underpass during three bat activity surveys undertaken in September 2015. Other recordings of note at Mill Reen underpass in 2014 include barbastelle in August and Nathusius' pipistrelle in September. Noctule bat was also recorded in 2014; however, noctule bats have very loud calls and often fly high in the sky. Therefore, I consider it unlikely that noctule bats were actually flying through Mill Reen underpass. Other species recorded in both 2014 and 2015 included common and soprano pipistrelles and Myotis species. These were confirmed as commuting both north and south through the underpasses throughout the dusk and dawn activity surveys in 2015.
- 3.2.10 Only a small number of common pipistrelles was recorded commuting through the B4245 underpass during the dusk survey in August and September 2015. No bats were recorded commuting over the M4 motorway bridges at Pound Hill at Castleton or Grange Road at Magor.

3.3 Bat roosts

- 3.3.1 There are many buildings and trees within the study area, some of which have been confirmed as bat roosts.

- 3.3.2 Construction of the Scheme would require the felling of the following trees and the demolition of the following buildings of known or probable value to roosting bats:
- a) Tree 274, located on Berryhill Farm at the western end of the Scheme - a confirmed summer day roost for individual soprano pipistrelle and noctule bats and possible additional unknown species (further survey will be undertaken in 2017 to attempt species confirmation);
 - b) Tree 80, located on Berryhill Farm at the western end of the Scheme - a confirmed summer day roost for three common pipistrelles and one brown long-eared bat;
 - c) Tree 375, located near Knollbury at the eastern end of the Scheme - a confirmed summer day roost for an individual bat of unknown species (further survey will be undertaken in 2017 to attempt species confirmation);
 - d) Tree 39, located close to Fox Covert to the east of Green Lane in Coedkernew – a probable common pipistrelle summer day roost;
 - e) Tree 45, located close to Fox Covert to the east of Green Lane in Coedkernew – a probable common pipistrelle summer day roost;
 - f) Tree X3, located to the north of the M4 to the east of The Elms underpass – a probable common pipistrelle summer day roost;
 - g) A disused lime kiln (ref. T335), located close to Tree X3 – a confirmed brown long-eared bat summer day roost (three bats observed);
 - h) Barecroft House – a residential property located just to the east of the A4810 and south of the South Wales Mainline railway, to the south west of Magor - a confirmed summer day roost for a small number of common pipistrelle bats (up to two observed);
 - i) Berryhill Cottage – a residential building undergoing renovation work following long-term neglect located to the north of Berryhill Farm and

the A48 – a confirmed common pipistrelle summer day roost (up to four bats observed) and soprano pipistrelle summer day roost (one bat observed);

- j) The Conifers - a residential property located to the west of Berryhill Farm - a confirmed common pipistrelle maternity roost (up to 55 bats observed); brown long-eared summer day roost (up to three bats observed); and soprano pipistrelle summer day roost (one bat observed);
- k) Undy House – a vacant and boarded-up residential property and old derelict outbuilding located to the north of the existing M4 and south of Knollbury - both buildings are confirmed common pipistrelle summer day roosts (single bats observed from each building);
- l) San Remo - a vacant residential property located between the existing M4 and A48 east of Castleton –a confirmed common pipistrelle bat day roost (up to eight bats observed);
- m) Woodland House (also referred to in survey reports as The Vicarage) - a residential property at the eastern end of the Scheme - a confirmed summer day roost for a small number of common pipistrelles (three bats observed); and
- n) The Old Stores building on the Newport Alexandra Docks, to the west of the River Usk – a possible roost for one or a small number of bats, likely to be pipistrelle (one unidentified bat possibly emerged from a broken window).

3.3.3 Bat roosts were also confirmed in the following buildings, which although would not be demolished to enable construction, are located relatively close to working areas and, therefore, works could result in disturbance to roosting bats:

- a) Fair Orchard Farm – a complex of farm buildings, including residential and barns located on Lighthouse Road, to the south of

the South Wales Mainline railway, south of Duffryn - three confirmed common pipistrelle bat summer day roosts (up to eight bats observed in total);

- b) Pye Corner Farm house – a confirmed roost for a small number of common pipistrelles (one bat observed on each of three emergence surveys);
- c) Berryhill Farm (within the Scheme boundary but being retained specifically to conserve the bat roosts) – a number of buildings located to the south of the existing M4 and A48 between Newport and Castleton, including an old large residential property (building 1), a garage and utility building (building 2), an old ‘calf’ shed (building 3) and another old shed used for cider making (building 4) - building 1 is considered to be a common pipistrelle maternity roost (up to 68 bats observed); building 2 is considered likely to be a brown long-eared maternity roost (up to nine bats observed) and a summer day roost for a small number of soprano pipistrelle bats (one bat observed) and a Myotis species (one bat observed); building 4 is considered to be a summer day roost for common pipistrelle bats (up to two bats observed); and
- d) Tatton Farm – a confirmed roost for a small number of common pipistrelles (up to two bats observed).

3.3.4 Locations of bat roosts and of high bat activity recorded in the 2014 and 2015 surveys are shown on Figure 10.8 of the March 2016 ES [Document 2.3.2]. Locations of trees and buildings surveyed in 2016 are shown on Figure 1 of Appendix SS10.2 and Figure 1 of Appendix SS10.3, both published within the December 2016 ES Supplement [Document 2.4.14]. Average bat activity indices for sensitive bat species recorded at static bat detector locations are shown on Figure 2 of the Draft Bat Mitigation Strategy (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]).

3.4 Evaluation

- 3.4.1 Following the methodology in Wray *et al.* (2010)¹, the March 2016 ES [Document 2.3.2] assesses the corridor of the proposed new section of motorway as of at least district level importance for lesser horseshoe bats and brown long-eared bats and between district and county level importance for pipistrelles. For all other bat species, the route is assessed as of regional value with regard to foraging and commuting behaviour. Overall the route corridor is assessed as being of regional (medium) importance for bats.
- 3.4.2 Wray *et al.* (2010) acknowledge that bats can be amongst the hardest of receptors to value consistently. One of the problems in assigning bat value to geographic frames of reference in ecological impact assessment is that the distribution and rarity of species varies greatly. Wray *et al.* (2010) categorise bats by distribution and rarity based on population estimates from 1995, 2000 and 2008. Bat survey techniques have developed greatly since then and, in general, bat surveys are demonstrating a wider geographical range and greater numbers of bats throughout England and Wales. The National Bat Monitoring Programme, coordinated by the Bat Conservation Trust, has shown that of the species monitored in Wales, including greater horseshoe, lesser horseshoe, Daubenton's bat, whiskered/Brandt's bat, Natterer's bat and brown long-eared bat, all except whiskered/Brandt's bat have shown an increase in population numbers since monitoring began in 1999.
- 3.4.3 The Wray *et al.* (2010) method is greatly affected by rarity; for example, as greater horseshoe bats are in the rarest category, only one pass recorded by this species over two seasons of surveys means that following the method in Wray *et al.* (2010), the corridor is valued as of regional importance for this species. Wray *et al.* state that their approach should be used as a framework rather than a rulebook. The assessment in the March 2016 ES [Document 2.3.2] takes a precautionary approach in its evaluation

¹ Wray S, Wells D, Long E, Mitchell-Jones T (December 2010). Valuing Bats in Ecological Impact Assessment, IEEM In-Practice p 23-25

of the Scheme corridor for bat species and it is my opinion that the method used may be over-valuing the area for some bat species. In my opinion the area provides some valuable foraging and commuting habitats for bats, particularly areas of woodland, hedgerows and tree lines along reens, whilst a lot of the fields between these boundary features are of relatively little value to bats because of the general intensive nature of farming in the area. When looking at the wider landscape, the area to the north of the existing M4 is much more wooded than the Scheme corridor and considered likely to be of greater value to most bat species, with perhaps Daubenton's and soprano pipistrelles being the exception because of their association with wetland habitats. This is borne out by the presence of statutory designated sites for lesser and greater horseshoe bats to the north of the existing M4, including Wye Valley and Forest of Dean Bat Sites SAC and Ruperra Castle and Woodlands SSSI. Perhaps a more realistic evaluation would be that the Scheme corridor is of county value to bats, given the availability of better habitat elsewhere in the region and that most of the bat activity recorded was from common and soprano pipistrelle bats, both of which are common and widespread species.

4. Potential Impacts of the Scheme on Bats

4.1.1 Road schemes can affect bats in various ways. Areas of potential impact which are relevant to most road proposals are as follows.

4.2 Effects of Land Take

4.2.1 Direct loss of habitats used for roosting, foraging and commuting through land take.

4.2.2 Severance and/or fragmentation where a scheme may create a barrier and divide existing habitats or affect the continuity of bat flight lines such as hedgerows, watercourses or existing under-road crossings, such as culverts and subways.

4.3 Effects of Construction

4.3.1 Road construction works can result in disturbance of roosting, foraging and commuting bats from activities involving noise, vibration and lighting. This may add to the continuing severance/fragmentation effects initiated during land take.

4.3.2 There is a risk of water pollution as a result of run-off from construction areas that could reduce the diversity and abundance of aquatic invertebrates that form part of bats' diets.

4.4 Effects of the Operational Road

4.4.1 Bats may be killed by impact with moving vehicles when crossing the road. This can be a particular problem for horseshoe and long-eared bats, which are slow flying and tend to fly at low-level over open spaces.

4.4.2 Disruption of hydrology may affect wetland sites and watercourses that provide important bat foraging areas.

4.4.3 Polluted runoff from roads may affect watercourses that provide important bat foraging areas.

- 4.4.4 Light-shy species, such as horseshoe bats, may be affected by road lighting, as they avoid lit areas, whilst more light-tolerant species can be attracted by insects flying around lights, increasing the risk of road traffic casualties. Insects may also be attracted from adjacent foraging habitats, reducing the available resource for bats foraging in these areas.
- 4.4.5 All of the above effects may contribute to an overall reduction in the value of habitats for bats close to roads, further exacerbating the barrier/severance effect of roads on bats.

5. Mitigation for Bats

5.1.1 Bat survey results and discussion with NRW informed the development of the Scheme design to minimise impacts on bats and, in particular, lesser and greater horseshoe bats, as qualifying features of the Wye Valley and Forest of Dean Bat Sites SAC.

5.1.2 In this section, I outline the relevant design and mitigation measures proposed, in relation to the potential impacts included in section 0. A Draft Bat Mitigation Strategy (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]) has been produced with the aim of agreeing a final version with NRW. This will be used to support a licence application for destruction of bat roosts.

5.2 Mitigation of effects of land take

Habitat loss

5.2.1 Whilst considering other environmental and engineering constraints, the Scheme alignment has been optimised to minimise impacts on bat foraging and commuting habitat and roosts.

5.2.2 Habitat creation and landscape planting would be provided as replacement habitat for valuable bat foraging habitats lost to the Scheme, as follows.

5.2.3 As part of the Reen Mitigation Strategy (Appendix 2.3 of the March 2016 ES [Document 2.3.2], also Supplementary File Note published as Appendix S2.1 of the September 2016 ES Supplement [Document 2.4.4]), reens and ditches would be replaced at an overall ratio of 1:1. In addition, proposals for SSSI mitigation include re-cutting of 5,865 m of former ditches at Maerdy Farm and Caldicot Moor. The overall ratio of ditch replacement on this basis would be 1:1.76. In addition, 9.4 ha of ponds would be created as part of the drainage system along the Scheme.

5.2.4 Reedbed would be replaced at a ratio of 1:1.5. A total of 6.59 ha would be lost and 9.9 ha provided.

- 5.2.5 Woodland would be replaced at an overall ratio of 1:2.1, creating extensive new woodland blocks at Berryhill Farm in the west, and east of Rockfield Farm at Undy in the east. 49.8 ha would be lost and 104.4 ha provided.
- 5.2.6 A total of 35.8 km of hedgerows would be lost, with 4.1 km of hedgerow planting provided. For calculation purposes, where two adjacent hedgerows, either side of a ditch or reen, forming one linear habitat feature are lost, the total length of hedgerow is counted, i.e., where a double hedgerow feature is severed across a width of, say 25 m, 50 m is the calculated loss of hedgerow. NRW has indicated that hedgerow planting would not be appropriate within the Gwent Levels SSSIs because hedgerows along the field boundaries can result in over-shading of the reens and field ditches with adverse effects on aquatic macrophytes and invertebrates which are the important features of the SSSIs. I consider the provision of over twice as much woodland habitat as that lost to off-set the loss of hedgerow habitat in terms of the future availability of bat foraging habitat.
- 5.2.7 In addition, I expect the ecological enhancement of land at Maerdy Farm, Tatton Farm and Caldicot Moor to increase the abundance and diversity of flying invertebrates in these areas, providing enhanced foraging areas for bats.
- 5.2.8 Where bat roosts have to be destroyed, alternative roosting provision is proposed to provide an ecological function of equal or better value within a similar spatial context. This would be done under licence and detail of replacement roosts agreed with NRW.
- 5.2.9 A purpose built lesser horseshoe bat maternity roost, also suitable for other species that roost in buildings, would be provided as early works at Water Treatment Area 11c north of Junction 23A at Magor (Figure 2.6 of the March 2016 ES) [Document 2.3.2]. This would replace the common pipistrelle bat roost at Woodland House (also referred to as Magor Vicarage), which would be removed to construct the Scheme. It would also mitigate for effects associated with loss of foraging habitat and severance

by providing a suitable bat roost for the majority of species, but in particular lesser horseshoe bats, in proximity to woodland habitat to the north of the existing M4. This would reduce the need for bats to cross the M4 to the south, when travelling from this new roost to valuable foraging areas. The design of the roost would be based on a similar roost provided on the A465 Heads of Valleys Section 2 Scheme, which was used by roosting lesser horseshoe bats less than a year after its completion.

- 5.2.10 A bat roost suitable for use by breeding common pipistrelle bats would be provided for the loss of the common pipistrelle bat maternity roost at The Conifers. A replacement common pipistrelle maternity roost has yet to be agreed with NRW but the Draft Bat Mitigation Strategy proposes a Schwegler 2FTH box mounted on a pole adjacent to Water Treatment Area 2, close to planted trees but receiving full sunlight to maximise thermal gain. Other roosts in buildings and trees used by low numbers of bats would be replaced using bat boxes on trees along the Scheme. The precise detail of replacement bat roosts would be agreed with NRW and included in the final Bat Mitigation Strategy and bat licence application.

Severance/fragmentation

- 5.2.11 The initial clearance of the Scheme corridor will result in severance of bat flight lines and fragmentation of bat habitats. Immediately after vegetation clearance, artificial 'bat corridors' (e.g. lines of fencing and/or debris netting) would be installed between important severed flight lines, i.e., in high bat activity areas (to be agreed with NRW and included in the final Bat Mitigation Strategy). These would be retained in place until construction work begins in that area, when they would be taken down during the day and replaced at night during the main period of bat activity (refer to 5.3.9 below).

5.3 Mitigation of effects of construction

Disturbance

- 5.3.1 In order to reduce disturbance to bats from noise and vibration, construction would be sensitive, in terms of timing and techniques. For

example, if working close to bat maternity roosts, such as at Berryhill Farm, work would be planned outside of the breeding season where possible and low-noise plant would be used. Generally, night-working would be avoided, although night-working would be required for a number of operations during the Scheme. This would be agreed by the Environmental Clerk of Works (ECoW) through the Environmental Management System (EMS) (refer to Commitment 23 in the Register of Commitments).

5.3.2 Any construction lighting would be limited to the local working area and times of working, other than security lighting at compound areas. Normal working hours would be 07.00 to 19.00 hours (Monday to Friday), and 07.00 to 17.00 hours on Saturdays. Lighting would be provided as required during periods of normal working hours in autumn and winter and for night time working. As far as possible, task lighting would be used for specific works to direct light towards the working areas.

5.3.3 Destruction of bat roosts unavoidably lost to the Scheme (including roosts in buildings and trees) would be carried out when bats are least likely to be present or at less critical times of year, avoiding the breeding and hibernation periods, as appropriate, to minimise disturbance to bats and prevent injury and mortality of bats. Additional measures, including exclusion of bats and inspecting for bats prior to demolition, along with capture and translocation of bats would avoid any mortality of bats. As an added precaution, such measures would also be undertaken on potential roosts that have not been confirmed to be used by bats. This would be done under NRW licence and alternative roosts would be provided for bats. A Draft Bat Mitigation Strategy (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]) has been produced with the aim of agreeing a final version with NRW. This will be used to support a licence application for destruction of bat roosts and other mitigation works.

Pollution

5.3.4 As explained by Mr Barry Woodman in his Proof of Evidence [WG 1.6.1], the Scheme would include standard measures to control pollution during

construction and these would be set out in a Construction Environmental Management Plan (CEMP) following the principles set out in the Pre-CEMP (Appendix SR3.2 in the December 2016 ES Supplement [Document 2.4.14]). This would avoid impacts on important wetland foraging habitat for bats.

Severance/fragmentation

- 5.3.5 The Scheme crosses reens and field ditches at a series of locations (see Appendix 2.3 of the March 2016 ES [Document 2.3.2], Appendix S2.2 in the September 2016 ES [Document 2.4.4] and Figure SR2.5 in the December 2016 ES Supplement [Document 2.4.14]). These reens and field ditches would be infilled, culverted or diverted as part of the Scheme. The available headroom between summer penning levels and the top of the culverts varies. A minimum of 200 mm freeboard would be provided in all reen culverts, although this is not considered adequate for bats to fly through. Culvert design is currently based on levels provided by the The Caldicot & Wentlooge Levels Drainage Board, as a detailed topographic survey has not been undertaken at this stage. A review would be undertaken during detailed design, once detailed topographical survey data is available, with a view to increasing culvert height and possibly width if necessary, within other constraints, to encourage bats to fly through them, rather than crossing over the road. In particular, in areas of high bat activity and where slower flying, more manoeuvrable species, such as horseshoe, long-eared and *Myotis* bat species have been recorded. These species are most at risk of road traffic mortality, as they tend to fly low over roads. At the same time, they are more likely to fly through culverts. Available headroom will be dependent on topography (to be confirmed by survey) but levels provided by The Caldicot & Wentlooge Levels Drainage Board indicate that headroom could be increased in a number of culverts, as shown in Table 5.3.1 below. These would be reviewed following detailed topographic survey in consultation with NRW as part of the final Bat Mitigation Strategy. Commitment 3 in the Register of Commitments states, '*Connectivity will be provided for commuting and foraging protected species; including provision of underpasses, overpasses and lighting strategies as required*'.

5.3.6 Table 5.3.1 existing culvert dimensions, existing and potential headroom available.

ID	Name	Type	Width (m)	Height (m)	Length	Existing headroom available (m)	Potential headroom available (m)
SBR-0510	Nant-y-Moor Reen Culvert - Extension of existing culvert	Extension of existing box culvert	1.8	1.8	25m	1.05	1.05
SBR-0570	Percoed Reen Bridge	Box culvert	4.2	2.1	58m	1.25	1.25
SBR-0835	Sea Wall Reen Bridge	Box culvert	4.2	2.1	94m	0.2 minimum	7
SBR-1480	Monk's Ditch Bridge	Box culvert	4.2	2.1	103m	1	1
SBR-1640	Steelworks Dedicated Reen Bridge	Box culvert	4.2	4.5	53m	0.2 but variable water level	0.2 but variable water level
SBR-1755	North Row Middle Road Reen Bridge (North)	Box culvert	4.2	2.1	30m	0.45	2.5
SBR-1770	North Row Middle Road Diversion Reen Bridge (South)	Box culvert	4.2	2.1	25m	0.45	1.5
SBR-1780	Middle Road Diversion Reen Bridge	Box culvert	4.2	2.1	61m	0.45	0.7
SMN-0550	SDR Reen Culvert	Box culvert	1.8	1.8	51m	0.2	1.4
SMN-0680	Morfa Gronw Reen Culvert	Box culvert	1.8	1.8	73m	0.2	1.8
SMN-0775	Old Dairy Reen Culvert	Box culvert	1.8	1.8	59m	0.2	1.4
SMW-0800	Pont-y-Cwch Culvert	Box culvert	1.8	1.8	59m	0.2	1.9
SMN-	Picked Lane Culvert	Box culvert	1.8	1.8	49m	0.2	0.2

ID	Name	Type	Width (m)	Height (m)	Length	Existing headroom available (m)	Potential headroom available (m)
1180							
SMN-1230	Lake's Reen Culvert	Box culvert	1.8	1.8	71m	0.2	1.1
SMN-1300	Julian's Reen Culvert	Box culvert	1.8	1.8	56m	0.2	0.67
SMN-1330	Tatton Farm Culvert	Box culvert	1.8	1.8	55m	0.2	1.7
SMN-1350	Field Culvert	Box culvert	1.8	1.8	57m	0.2	1.6
SMN-1430	Ellen's Reen Culvert	Box culvert	1.8	1.8	59m	0.2	1.35
SMN-1480	Blackwall Reen Culvert	Box culvert	1.8	1.8	113m	0.2	1
SMN-1655	Elver Pill Reen Culvert	Box culvert	1.8	1.8	60m	0.2	1.25
SMN-1720	New Cut Reen Culvert	Box culvert	1.8	1.8	57m	0.2	0.95
SMN-1850	Cock Street Reen Culvert	Box culvert	1.8	1.8	55m	0.2	1.2
SMN-1925	Petty Reen Culvert	Box culvert	1.8	1.8	63m	0.2	1.6

5.3.7 In addition, 900 mm diameter dry mammal underpasses would be provided adjacent to each culvert, as well as in a number of other locations away from reens, as shown on Figure 2.6 of the March 2016 ES [Document 2.3.2], and these could also be used by slower flying, more manoeuvrable species to safely cross the road. Where the road rises in vertical alignment, such as in the Berryhill Farm area, heights in excess of 4 metres could be provided, such that an oversized culvert/underpass could be provided at Athensway Culvert (ch. 4300).

5.3.8 The detailed design of tree and scrub planting would have regard to guiding bats to these culverts and underpasses. Planting in these areas would be carried out as soon as practicable, once it can be confirmed that ongoing construction would not result in damage to the new planting.

5.3.9 Whilst planting becomes established, in order to help guide bats to crossing points prior to the commencement of operation, artificial 'bat corridors' (e.g.

lines of hazel hurdle fencing or debris netting) would be installed between crossing points and retained habitats in or connected to high bat activity areas (as described in the Draft Bat Mitigation Strategy, Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]). These would be in place at least during night time hours between March and October inclusive (the main period of bat activity) and until landscape planting has become sufficiently developed to provide a permanent alternative.

5.4 Mitigation of effects of the operational road

Road traffic casualties

5.4.1 In accordance with Highways Agency recommendations (A Review of Bat Mitigation in Relation to Highway Severance, Highways Agency, 2011 [Document 11.2.25]), in order to help minimise the risk of collision with vehicles, where practicable and appropriate for landscape objectives, tree and shrub planting would be set back from the road edge so as to help keep bats away from the road, apart from at safe crossing locations.

5.4.2 The risk of bats being hit by traffic would be reduced by the provision of culverts and bridges, as discussed in 5.3.5 above. Initial clearance of vegetation either side of the carriageway in advance of the works, with guidance structures erected to lead bats to culvert entrances, would discourage low flying bat species from crossing over the road and encourage them to use the culverts. Planting would be designed to guide bats towards re-en culverts and mammal tunnels, underpasses and overbridges.

Disruption of hydrology

5.4.3 Providing watercourse and re-en connections across the line of the new section of motorway is intrinsic to the design of the Scheme. This would avoid significant impacts on hydrology.

Pollution runoff

5.4.4 As explained by Mr Richard Graham in his Proof of Evidence [WG 1.15.1], runoff from the new section of motorway would be intercepted and treated

by various means, including grassed channels, water treatment areas, oil separator and storage lagoon. This would avoid impacts on important wetland foraging habitat for bats.

Road lighting

5.4.5 As explained by Mr Ben Sibert in his Proof of Evidence [WG 1.5.1], the new section of motorway would generally be unlit other than at the following locations.

- a) On the approaches to and throughout the Castleton Interchange.
- b) On the approaches to the Docks Way Junction and over the full extent of the River Usk Crossing.
- c) On the approaches to and throughout the Glan Llyn Junction and on the new link road connecting the new section of motorway with the A4810 and the A4810 junction and approaches.
- d) On the approaches to and throughout the Magor Interchange.

5.4.6 Commitment 134 in the Register of Commitments states, '*An appropriate lighting strategy would be implemented to avoid lighting of the new section of motorway except at Junctions and river crossings. Lighting of the River Usk and Ebbw crossings would avoid lighting of the river channel*'. This would avoid disturbing bats commuting and foraging along the rivers.

5.4.7 As explained in March 2016 ES Chapter 2: Scheme Description [Document 2.3.2], luminaires would be designed to emit no light above the horizontal level. LED luminaires would be used, as these can be aimed more precisely, reducing light spill into adjoining habitats.

Severance/fragmentation

5.4.8 As stated in 5.3.9 above, in order to help guide bats to crossing points whilst planting becomes established, artificial 'bat corridors' would be installed between crossing points and retained habitats in or connected to high bat activity areas. These would be retained/maintained until such time as vegetation has established sufficiently to act as permanent bat corridors, expected to be within ten years of planting.

6. Residual Effects of the Scheme on Bats

6.1.1 In this section I summarise the residual effects (after mitigation) of the land take, construction and operation of the Scheme on bats as reported in Chapter 10: Ecology and Nature Conservation of the March 2016 ES [Document 2.3.2] and updated in the September 2016 ES [Document 2.4.4] and the December 2016 ES [Document 2.4.14].

6.2 Residual effects of land take

Habitat loss

- 6.2.1 The proposed new section of motorway would affect foraging, commuting and roosting habitats that support bats.
- 6.2.2 Construction of the Scheme would require the felling of trees and demolition of buildings of known or probable value to roosting bats. This work would require a European Protected Species licence, which would be obtained prior to the commencement of the licensable works.
- 6.2.3 The total number of known tree roosts that would be destroyed consists of three confirmed and three probable roosts, affecting low numbers (between one and three bats) of common pipistrelle, brown long-eared and noctule bats. The total number of buildings with roosting bats that would be destroyed consists of nine buildings, affecting seven low value common pipistrelle bat roosts, two low value soprano pipistrelle bat roosts, one low value brown long-eared bat roost and one common pipistrelle bat maternity roost (refer to 3.3.2 above).
- 6.2.4 Most of the roosts are used by low numbers of common crevice-dwelling species and are of low value. Proposed mitigation for the loss of low value roosts comprises bat boxes provided on retained trees along the route. This is an established and uncontroversial mitigation technique, i.e., all the bat species using the roosts to be destroyed are known to roost in appropriately sited bat boxes. A replacement common pipistrelle maternity roost has yet to be agreed with NRW but could include the provision of a

- Schwegler 2FTH box mounted on a pole adjacent to Water Treatment Area 2, close to planted trees but receiving full sunlight to maximise thermal gain. The provision of replacement roosts would ensure that bats have alternative roosts of at least equal functional value within the same spatial area as those lost.
- 6.2.5 Considering the mobile nature of bats, the provision of bat boxes and suitable maternity bat roosts at Magor and the west end of the Scheme, and that mitigation measures would include further, pre-construction surveys of mature trees and buildings to inform the final Bat Mitigation Strategy and licence application, I conclude that the Scheme is unlikely to have a significant adverse impact on bat populations due to loss of roost sites.
- 6.2.6 Habitats of value to bats which would be lost include woodland, reens and their rough grassland or tree-lined banks, and hedgerows. The Scheme landscaping includes woodland, linear tree belts and scrub planting. Reens and ditches would be constructed to replace the lost watercourses and there would be some hedgerow planting.
- 6.2.7 In the long-term, there would be an increase in the area of woodland, ponds and reedbed, providing valuable bat foraging habitats. There would be a decrease in hedges but I consider provision of over twice as much woodland habitat as that lost to off-set the loss of hedgerow habitat.
- 6.2.8 There would be a period between clearance of habitat for Scheme construction and the maturation of new habitats and planting. The value of new ponds and reedbeds is expected to reach full potential as bat foraging habitat within ten years, whilst planted woodland would provide some foraging habitat within ten to twenty years, with the value increasing beyond that time as it matures.
- 6.2.9 In my opinion, there would be a moderate adverse effect of moderate significance on bats due to temporary habitat loss in the short (1-3 years) and medium-term (4-9 years). This will extend into the long-term (greater

than 9 years), until woodland planting and other habitats proposed as part of the Scheme landscaping mature sufficiently to provide habitat structure and sufficient invertebrate biomass. I estimate this to be between 10 and 20 years to be of notable value to bats and 50 to 100 years to reach full woodland maturity. In the long-term, I consider the magnitude of habitat loss to reduce to minor adverse between 10 and 20 years and to neutral within 50 years, when habitats have matured.

Severance/fragmentation

- 6.2.10 A study by Berthinussen, A. and Altringham, J. (2015)² reports that roads have a long-term negative impact on bat populations and that the scale of the impact (extending up to 1.6 km either side of a motorway) indicates a barrier effect. They advise that mitigation can remove the barrier and/or remove its impact.
- 6.2.11 Culverts, mammal tunnels and underpasses would provide routes which bats could use to safely cross the new section of motorway. However, Evidence for the effectiveness of the proposed culverts and mammal tunnels is limited and the extent to which bats would use the culverts and/or mammal crossings is not possible to predict exactly.
- 6.2.12 In my opinion, even after taking into account mitigation, specifically: the provision of mammal tunnels adjacent to all re-en culverts; the construction of mammal crossings along the route to include locations associated with high bat activity; the detailed alignment of mammal exclusion fencing; the location of planting to help to lead bats to safe crossing points; and minimising light spill from the highway lighting where provided, on a precautionary basis the magnitude of impact is correctly assessed as moderate adverse and the significance of effects as moderate. The magnitude of impact could be reduced by increasing headroom in culverts, where possible, at detailed design.

²Berthinussen, A. and Altringham, J. (2015). Development of a cost-effective method for monitoring the effectiveness of mitigation for bats crossing linear transport infrastructure. Defra contract report WC1060

6.3 Residual effects of construction

Disturbance

- 6.3.1 Since working at night would be limited in frequency and extent, and given the mitigation measures to avoid and reduce construction lighting impacts, in my opinion the magnitude of impact would be minor adverse and the temporary effect of construction lighting on foraging and commuting bats would be of slight significance.
- 6.3.2 Most construction activity would be undertaken during the day, whilst bats are roosting. Given the landscapes through which the Scheme passes, there are not expected to be any significant roosts near to the construction area that have not already been discovered. Bats, including lesser horseshoe bats, can be relatively tolerant of noise whilst roosting, particularly if the noise is relatively regular. In my opinion, disturbance of roosting bats from noise and vibration is extremely unlikely.
- 6.3.3 It is likely that there would be some changes in bat activity whilst crossing points are constructed and until bats locate these and replacement bat roosts. Measures would be implemented to help bats locate these features, including locating them at or close to sites of high bat activity, and the installation of guide fencing and bat corridors (refer to Commitment 64a in the Register of Commitments). As discussed above in 6.2.11, the Evidence for the effectiveness of the proposed culverts and mammal tunnels is limited and the extent to which bats would use the culverts and/or mammal crossings is not possible to confidently predict. Other mitigation measures would include the use of sympathetic lighting and monitoring surveys to inform the need for consideration of revisions to the Scheme mitigation measures, such as additional planting. It is also the case that there are alternative bat foraging habitats in the immediately surrounding area that bats could utilise should they be deterred from crossing the road during construction. In my opinion, the magnitude of the residual impact of construction on bats is correctly assessed as moderate adverse and of a

temporary short-term nature. The effects are assessed as of moderate significance in the short-term.

Pollution

- 6.3.4 In order to reduce the likelihood and likely impact of pollutants, construction would be undertaken in accordance with the CEMP following the principles set out in the Pre-CEMP (Appendix SR3.2 in the December 2016 ES Supplement [Document 2.4.14] and Commitment 96 in the Register of Commitments).
- 6.3.5 In my opinion, this would ensure that airborne and runoff pollutants would not present a significant risk to bats during construction.

6.4 Residual effects of the operational road

Disruption of hydrology

- 6.4.1 Watercourses and reed connections across the line of the new section of motorway would be retained or replaced to maintain the hydrology of the surrounding land. In my opinion, there would be no significant adverse effect on bats from disruption of hydrology during operation of the Scheme.

Road traffic casualties and severance

- 6.4.2 Roads present a risk of injury and fatality to bats as a result of collision with vehicles. In particular, young dispersing bats, low-flying and gleaning species (such as long-eared and lesser horseshoe bats) are more at risk of collision than higher-flying species (such as noctules and pipistrelles, which usually fly above vehicle height).
- 6.4.3 Taking into account the potential risk of vehicle collision and the long-term disruption to the movement of bats, with mitigation measures, specifically: the provision of safe crossings and planting to lead bats to them; and avoiding woodland planting at the roadside edge, it is my opinion that the magnitude of the residual impact of operation on bats is correctly assessed as moderate adverse and the significance of effects as moderate.

Pollution runoff

- 6.4.4 The measures described in 5.4.4 would protect the watercourses and aquatic invertebrates against potential effects of water pollution, and in turn the populations of bats which depend on them. In my opinion, with these measures in place, there would be no significant adverse effect on bats from pollution runoff during operation of the Scheme.

Road lighting

- 6.4.5 Road lighting could increase the risk of vehicle collisions for some bat species (such as pipistrelles, serotine and noctules), which are attracted to the insects that can be found around lights. For some species of bats, such as horseshoe bats, lighting can act as a deterrent affecting commuting, dispersal and population interactions.
- 6.4.6 The new section of motorway would be unlit apart from Junctions and their approaches and the River Usk Crossing. As part of the Scheme, in order to minimise the potential impact of operational lighting, where practicable and safe, lighting would take into account best practice recommendations and guidelines published by the Bat Conservation Trust and the Institution of Lighting Engineers (2009) [Document 11.3.6]. Where lighting is installed, light fixtures would be directed towards the new road and away from culverts, mammal crossings, underpasses and overbridges, as well as surrounding habitat of potential value to bats (including areas of woodland, scrub, watercourses and mature trees) and buildings of known or potential value to roosting bats. In my opinion the magnitude of impact of road lighting on bats would be minor adverse and the effect of lighting on foraging and commuting bats would be of slight significance.

6.5 Residual effects of the Scheme on the Wye Valley and Forest of Dean Bat Sites SAC

- 6.5.1 The effects on the Wye Valley and Forest of Dean Bat Sites SAC, in the context of the Conservation of Habitats and Species Regulations 2010 [Document 3.1.22] and, in compliance with the Design Manual for Roads and Bridges (DMRB) HD 44/09 [Document 6.1.8], Assessment of

Implications (of Highways and/or Roads Projects) on European Sites (including Appropriate Assessment), is contained within the AIES process and supporting Documents [Document 2.3.4].

- 6.5.2 Considering the distance between the Scheme and the SAC and the limited numbers of lesser and greater horseshoe bats recorded in the survey area during 2014 and 2015, with mitigation, including a new bat house and provision of under-road crossings, the Scheme would not conflict with the Conservation Objectives of the SAC. It is therefore concluded, and I agree, that there would be no adverse effect on the viability of the SAC bat populations or integrity of the SAC with regard to bats. NRW, in principle, agree with the conclusion (subject to not finding any lesser or greater horseshoe bat maternity roosts, and provision of hedges throughout the eastern section of the Scheme to ensure foraging and commuting routes are provided).

7. Consultees' Responses and Objections to the Scheme

7.1.1 Consultation responses and objections to the Draft Orders for the Scheme which are relevant to bats have been submitted by the following organisations:

- a) Natural Resources Wales (OBJ0268)
- b) Gwent Wildlife Trust (OBJ0270)
- c) Newport City Council (SU0192)
- d) Monmouthshire County Council (ISU0002)
- e) Wildlife Trusts Wales (OBJ0260)
- f) Woodland Trust (OBJ0271) (light pollution of ancient woodland affecting bats)
- g) Bat Conservation Trust (OBJ0298)

7.1.2 In this section I respond to the comments regarding bats made by these organisations.

7.2 Natural Resources Wales (OBJ0268)

7.2.1 NRW were unable to fully comment in May 2016 as a number of surveys were outstanding. For this reason, they were unable to fully assess the likely effects on and proposed mitigation put forward for bats or agree with the assessments and conclusions in the March 2016 ES [Document 2.3.2].

7.2.2 NRW requested that a detailed conservation strategy be provided for bats to enable assessment as to whether there will be a detriment to the maintenance of their favourable conservation status (FCS).

7.2.3 Further surveys have been undertaken since the initial consultation. The results of these surveys were published as Appendix SS10.2 of the December 2016 ES Supplement [Document 2.4.14].

7.2.4 A Draft Bat Mitigation Strategy has been produced with the aim of agreeing a final version with NRW (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]). In particular, this addresses the effects on bat species more sensitive to roads and makes recommendations for increasing headroom in culverts at detailed design stage. The Strategy also includes details of proposed pre-construction surveys in 2017. The results of these will inform the finer detail of mitigation measures, which will be developed at detailed design stage and include replacement bat roosts, under-road crossings, landscaping/planting and temporary measures to guide bats over/under the road during construction.

7.3 Gwent Wildlife Trust (OBJ0270)

7.3.1 GWT raise a number of issues, listed below in italics. Most of these refer to design and mitigation for bats. A Draft Bat Mitigation Strategy has been produced (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]). The Strategy will be developed further in consultation with NRW (refer to 7.2.4 above).

7.3.2 *“The EMPs do not reflect the findings of the bat surveys. Provisions of underpasses/culverts to optimise bat use and habitat planting are minimal in key areas of bat activity south of Duffryn and west of Magor. It appears either that design plans have not taken bat information into account or plans have been drawn up before advice was available.”*

7.3.3 The preliminary design was initially based on 2014 survey results. Surveys undertaken in 2015 also informed the assessment and surveys undertaken in 2016 have also informed the Draft Bat Mitigation Strategy (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]).

7.3.4 South of Duffryn, SDR Reen Culvert would provide 1.26m of freeboard above summer penning level. This is at the lower end of culvert sizes that are considered to be used by Myotis species and long-eared bats. Barbastelle and greater horseshoe (only one record) are less likely to fly through these culverts but will be able to cross the road by flying through

the Duffryn Railway Underbridge, which is 29.91m wide by a minimum of 5.45m high. Bats may also choose to use Fair Orchard Farm Overbridge as a means of crossing over the road, although the use of bridges is less likely than the use of culverts and underpasses. The road across most of the Wentlooge Levels would not be lit and there is a risk that some bats would choose to fly over the road at risk of mortality. There is availability to increase the height of culverts under the road across the Wentlooge Levels, providing additional headroom above summer penning levels in Percoed Reen Bridge, Morfa Gronw Reen Culvert, Old Dairy Reen Culvert and Pont-y-Cwch Reen Culvert between 1.2m and 1.9m (based on historic data but not subject to detailed topographic survey at this stage), which would make the road much more permeable to bats along this section. This would be considered further at detailed design stage.

- 7.3.5 To the west of Magor, there are no potential crossing structures proposed between the South Wales Mainline Railway Underpass and St Bride's Road. However, lesser horseshoe, long-eared, barbastelle and Myotis species bats in this area are considered unlikely to be crossing the existing A4810, which is lit from the Magor interchange/Junction 23A to the South Wales Mainline Railway and lies adjacent to the proposed line of the Scheme in this area. If crossing the existing A4810 presently, bats are likely to be using the existing South Wales Mainline Railway underpass on the A4810.
- 7.3.6 Bats recorded in this location, including Myotis species, long-eared, barbastelle and lesser horseshoe bats, will be able to cross under the road using the new South Wales Mainline Railway Underpass (27m wide by min. 5.45m high) and Bareland Street Underbridge (11m wide by min. 5.3m high). There is also availability to increase the headroom of Petty Reen Culvert (to around 1.6 m based on The Caldicot & Wentlooge Levels Drainage Board data) plus a number of other culverts across the Caldicot Levels. This would be considered further at detailed design stage (refer to the Draft Bat Mitigation Strategy (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]).

- 7.3.7 *“The Scheme has not provided a parallel habitat corridor for bats at Magor.”*
- 7.3.8 The Scheme includes woodland planting along the eastern side of the embankment at Magor, which, in my opinion, would provide a parallel habitat corridor for bats.
- 7.3.9 *“Mitigation proposed in the Scheme cannot have taken into account the habitat, crossing points and roost mitigation requirements of lesser horseshoe bat as their flight lines and roost locations at Magor and Pye Corner are not adequately understood.”*
- 7.3.10 Following recommendations by Arup in their 2014 bat survey report, further bat surveys to be undertaken were agreed with NRW. It was agreed with NRW that effectively trapping lesser horseshoe bats for a radio-tracking study would be very difficult and impracticable, i.e., to capture bats without targeting a known roost, and not worth pursuing. Bat emergence surveys were carried out at five groups of buildings in the vicinity of the new section of motorway considered to have the potential to support bat roosts. Tatton Farm, Pye Corner Farm and Woodland House (also referred to as Magor Vicarage) at Magor were particularly targeted for their potential for lesser horseshoe bat roosts as the species had been recorded in these areas. It has been concluded that the Scheme would not affect any lesser horseshoe bat roosts.
- 7.3.11 Potential bat crossing locations to the west of Magor are considered in paragraphs 7.3.5 and 7.3.6 above.
- 7.3.12 Around Pye Corner, Tatton Farm Culvert (ch. 13,300) and Field Culvert (ch. 13,500) would provide headroom above the summer penning level of 1.15m. This is at the lower end of culvert sizes that are considered to be used by lesser horseshoe bats. However, there is availability to increase the headroom of these culverts to around 1.6m, along with Lakes Reen Culvert (ch. 12,300) to around 1.1m (based on Drainage Board data). This would be considered further at detailed design stage (refer to the Draft Bat

Mitigation Strategy (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]).

- 7.3.13 In addition, a purpose built lesser horseshoe bat maternity roost would be provided as advanced works at water treatment area 11c north of Junction 23A at Magor (Figure 2.6 of the ES) [Document 2.3.2].
- 7.3.14 *“Mitigation measures for bats in Table 10.18 are inadequate. 900mm tunnels only likely to be used by Daubenton’s bat. 900mm tunnels not designed with bats in mind. All culvert sizes should be reviewed with bats in mind. Under-bridges should have been provided where possible.”*
- 7.3.15 Culvert height is limited by the proposed embankment height but having undertaken a review of existing levels data there is availability to increase the headroom of some of the culverts across the Scheme. This would be considered further at detailed design stage (refer to the Draft Bat Mitigation Strategy (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.14]). Limpens *et al.* (2005)³ includes a table on page 15 showing types and dimensions of passage structures suitable for bat species to safely cross roads. Of species found in the UK, Limpens *et al.* (2005) considers culverts 1m high by 2 m wide to be suitable for lesser horseshoe, Natterer’s and Daubenton’s bats, whilst bridges over water less than or equal to 1 m (above water) are considered suitable for lesser horseshoe, Natterer’s, Bechstein’s, brown long-eared, grey long-eared and Daubenton’s bats. Lesser horseshoe bats have been recorded flying through 300 mm diameter road drains on the A465 Heads of the Valleys road. Limpens *et al.* (2005) considers viaducts (bridges) suitable for lesser horseshoe, Natterer’s, Bechstein’s, brown long-eared, grey long-eared, greater horseshoe, whiskered, Brandt’s, barbastelle, soprano pipistrelle, common pipistrelle, Nathusius’ pipistrelle, serotine and noctule. However, they recognised that the more open the landscape and the longer the

³ Limpens H.J.G.A., Twisk P & Veenbaas G (2005). Bats and road construction. Brochure about bats and the ways in which practical measures can be taken to observe the legal duty of care for bats in planning, constructing, reconstructing and managing roads. Published by the Dutch Ministry of Transport, Public Works and Water Management Directorate-General for Public Works and Water Management, Road and Hydraulic Engineering Institute, Delft, the Netherlands and the Association for the Study and Conservation of Mammals, Arnhem, the Netherlands, 24 pages

bridge span, the less likely it is that bridges would be used by bats.

Limpens *et al.* (2005) cite that common pipistrelle and serotine bats have been observed following railings over bridges. In order to increase the suitability of bridges as safe crossings for bats over the road, all parapets would be solid, to provide shelter, screening from vehicle lights and a solid feature for bats to follow over the road. Whilst Limpens *et al.* (2005) provide dimensions considered suitable for different bat species, in my opinion the larger the cross section of a structure, most importantly the height, the greater the likelihood is of it being used by bats to cross under the road. As stated earlier, a review would be undertaken during detailed design, once detailed topographical survey data is available, with a view to increasing culvert height and possibly width if necessary, within other constraints. In particular, in areas of high bat activity and where species more at risk of road mortality have been recorded.

7.3.16 Mitigation measures would be further developed at detailed design stage in consultation with NRW and incorporated into the final Bat Mitigation Strategy. Table 7.3.1 below includes large underpasses that would provide potential crossing locations for bats, as well as reen crossings with a freeboard of 1 metre or more and unlit overbridges, which could also be used by bats as a feature to cross the road. It is also expected that headroom in a number of culverts could be increased at detailed design stage (refer to Table 5.3.1).

7.3.17 Table 7.3.1. Under-road structures with over 1 m headroom

Ref	Chainage	Name	Details
Large underbridges			
SBR-0650	6,500	Duffryn Railway Underbridge	Structure span to be 29.91 m with a minimum headroom of 5.45 m and a length of 208 m.
SBR-0850	8,500	River Ebbw Underbridge	Structure consists of three separate spans to be 48 m, 78 m and 52 m.
SBR-1000	9,300-11,400	River Usk Crossing	2.1 km long elevated structure over Newport Docks, the River Usk and the industrial area around Stephenson Street and Corporation Road.
SBR-1980	19,800	Bareland Street Underbridge	Structure to be 37.9 m long, with a clear span of 10.95 m (to accommodate 5.5 m wide carriageway and two 2.5 m wide verges) and a minimum headroom of 5.3 m.

Ref	Chainage	Name	Details
SBR-2000	20,075	Llandeenny Railway Underbridge	Structure span to be 287.05 m with a minimum headroom of 5.45 m.
SBR-2120A	21,225	St Bride's Road Underbridge	Proposed extension to existing Magor Penhow Underbridge to carry the new section of motorway over St Bride's Road. Existing structure has a clear span of 9.14 m and is approximately 40 m long. It is proposed to extend this by 32.7 m on the north side and 20 m on the south side. Headroom in extension would be increased to a minimum of 5.3 m.
SBR-2265	22,700	Rockfield Lane Underbridge 2	Proposed underbridge carrying the new section of motorway and reclassified M4 over Rockfield Lane. Structure consists of concrete box with internal dimensions 7.9 m wide by min. 5.3 m high, with a length of 42.07 m. To accommodate 5.5 m wide carriageway and two 1.2 m wide verges).
Overbridges			
SBR-0460	4,625	Church Lane Overbridge	Proposed overbridge carrying side road over the new section of motorway. Structure consists of two span integral bridge formed from pre-stressed concrete beams supporting a concrete deck slab. Structure spans: 30 m and 29.6 m, carrying a single carriageway 5 m wide.
SBR-0580	5,775	Percoed NMU Bridge	Proposed structure to carry the Newport/Cardiff cycle way over the proposed new section of motorway. Structure consists of multi-span steel structure supported on bearings on reinforced concrete piers. Length of spans would vary between 21 m and 48 m. Overall length of structure: 220 m (main span: 48 m).
SBR-0740	7,350	Lighthouse Road Overbridge	Proposed overbridge carrying side road over the new section of motorway Structure consists of two span integral bridge formed from pre-stressed concrete beams supporting a reinforced concrete deck slab. Structure spans: 28 m and 30 m, carrying a single carriageway 6.3 m wide.
SBR-0805	8,025	New Dairy Farm Overbridge	Proposed overbridge carrying access over the new section of motorway. Structure consists of pre-stressed concrete beams supporting a concrete deck slab. Structure spans: 32.8 m and 32.2 m, carrying a single carriageway 5 m wide and a 2.5 m wide footpath.
SBR-1210	12,575	Nash Road Overbridge	Proposed overbridge carrying side road over the new section of motorway. Structure consists of two span integral bridge formed from pre-stressed concrete beams supporting a reinforced concrete deck slab. Structure spans: 2 x 31 m, carrying a single carriageway 6.5 m wide and 3.0 m footway/cycleway.
SBR-1760	17,550	North Row Overbridge	Proposed overbridge carrying side road over the new section of motorway (Figure 2.14). Structure consists of two span integral bridge formed from pre-stressed concrete beams supporting a reinforced concrete deck slab. Structure spans: 30.1 m and 27.6 m, carrying a single carriageway 4.8 m wide.
Reen culverts with over 1 m freeboard			

Ref	Chainage	Name	Details
SBR0510	5,100	Nant-y-Moor Reen Culvert	Single span box culvert. Internal dimensions would be 1.8 x 1.8 x 25 m. 1.05 m freeboard
SBR 0570	5,750	Percoed Reen Bridge	Single span box culvert. Internal dimensions 4.2 x 2.1 x 58 m. 1.25 m freeboard
SMN 1330	13,300	Tatton Farm Culvert	Single span pre-cast box culvert. Internal dimensions would be 1.8 x 1.8 x 55 m. 1.15 m freeboard
SMN 1350	13,540	Field Culvert	Single span pre-cast box culvert. Internal dimensions would be 1.8 x 1.8 x 54 m. 1.15 m freeboard
SBR 1480	14,800	Monk's Ditch Bridge	Single span box culvert. Internal dimensions 4.2 x 2.1 x 103 m. 1.0 m freeboard

- 7.3.18 Landscape plans will also be developed so that planting and temporary measures are provided to guide bats to all potential crossing structures from existing flight lines.
- 7.3.19 *“Landscape plans do not take into account the requirements of bats particularly in the area to the west of Magor. Seeking increased woodland and shrub planting. Also additional hedge and shrub plantings along bat flight routes in the area south of Duffryn.”*
- 7.3.20 Preliminary landscape plans took into account a range of issues, such as landscape, visual amenity and ecology, including bats. Planting includes woodland and linear belts of shrubs and trees to the west of Magor and across the Scheme, which, in my opinion provide suitable bat flight routes to connect retained habitats and under-road crossings. Planting schedules would be further developed at detailed design stage to include plant species that would provide both short-term and long-term cover (refer to Commitment 54, ‘*The early re-establishment of vegetation within the highway boundary*’ in the Register of Commitments).
- 7.3.21 *“GWT is in a key position to help with identification of bat flight routes in the vicinity of Barecroft and Magor Marsh and would welcome future involvement. Siting of bat friendly features on their land may be possible.”*
- 7.3.22 Peter Ireland has been seeking a meeting to discuss opportunities with GWT and he can comment further.

- 7.3.23 “Bats are a notified feature of the Lower Usk SSSI and the impacts on the river corridor in relation to bats should have been assessed (refers to para 2.3.7 of the 2015 Bat Activity Report).”
- 7.3.24 The special features of the River Usk (Lower Usk) SSSI as set out in the Site Management Statement (refer to paragraph 10.4.5 of the March 2016 ES [Document 2.3.2]) are:
- a) Running water supporting *Ranunculion* vegetation.
 - b) Otter.
 - c) Fish species.
 - d) A group of rare craneflies.
- 7.3.25 The SSSI citation does refer to bats as follows. “The frequent tree cover provides valuable feeding and roosting habitats for several bat species including Daubenton's bat *Myotis daubentonii*.”
- 7.3.26 The River Usk Lower Usk) SSSI extends for some 58 km from the River Usk Bridge in Abergavenny to the mouth of the river south of Newport. Whilst sections of the river corridor upstream of Newport have extensive tree cover, this is not the case for the wide tidal section of the river through Newport. This statement in the SSSI citation clearly refers to the river upstream of Newport.
- 7.3.27 However, it is the case that there is some bat activity within Newport Docks. As reported in Chapter 10 of the March 2016 ES [Document 2.3.2], the desk study reported common pipistrelle and noctule near to the River Usk at Newport Docks (10.2.48). In the 2015 bat roost survey, an old stores building in Newport Docks was identified as a bat roost for a small number of common pipistrelle bats (10.4.253).
- 7.3.28 Surveys of bat activity were carried out on the east bank of the River Usk where there was some vegetation in 2014. Transect 5 included this section of the east bank of the river and recorded relatively low levels of activity

compared to other transects. The tree lined sections of the National Cycle Path recorded higher levels of bat activity on this transect. The more open areas near Pye Corner and the industrial areas had very low levels of bat activity or no activity recorded at all (March 2016 ES [Document 2.3.2], Appendix 10.7, paragraph 3.3.5). On the section of the transect at the east bank of the River Usk, no bats were recorded in April, June, September and October. In May, eight common pipistrelle passes were recorded, in July, one noctule, and in August, twelve common pipistrelle and one soprano pipistrelle.

- 7.3.29 Static detector 9 was located in the scrub on the east bank of the River Usk. Over the seven-month monitoring period, only low levels of bat activity were recorded. The species present were noctule, common and soprano pipistrelle, with records of *Myotis* species and unidentified bat species in one month each.
- 7.3.30 It is clear that the River Usk at the location of the proposed crossing is of low value for bats.
- 7.3.31 The effects of the proposed Usk Crossing on bats have been assessed. The presence of the bridge structure itself, given the clearance beneath it would have no significant effect on bats. The presence of operational lighting on the bridge is referred to in the section on operational effects of the road on bats at paragraph 10.9.266 of the March 2016 ES [Document 2.3.2], and this lighting would be directed towards the road and away from adjacent habitats. The effects of lighting of the Usk Crossing on bats is also referred to at paragraph 10.9.277 of the March 2016 ES [Document 2.3.2]. Commitment 134 in the Register of Commitments states, '*An appropriate lighting strategy would be implemented to avoid lighting of the new section of motorway except at Junctions and river crossings. Lighting of the River Usk and Ebbw crossings would avoid lighting of the river channel*'.
- 7.3.32 Given the low levels of bat activity recorded and the commitment to ecologically sensitive lighting design, in my opinion the effects of the proposed Usk Crossing on bats would not be significant.

7.4 Newport City Council (SU0192)

7.4.1 NCC state, “*The [bat survey] methodology has been agreed with NRW. We believe further surveys of those buildings/tree that were inaccessible are expected in 2016 and we require clarification of this*”.

7.4.2 Further surveys have been undertaken since the initial consultation and the results of these surveys are published as Appendix SS10.2 and Appendix SS10.3 of the December 2016 ES Supplement [Document 2.4.14].

7.5 Monmouthshire County Council (ISU0002)

7.5.1 “*The area of landscape surrounding the bat barn will need careful consideration. It is noted that the immediate surroundings are wooded but the field boundaries in this area may not be sufficient and wider landscape improvements should be considered.*”

7.5.2 There are a number of hedges along field boundaries in this area providing links into the surrounding countryside. There would be extensive planting of woodland and linear plantings of trees and shrubs associated with the Scheme in this area that would provide additional habitat and connections for bats in the medium-term.

7.6 Wildlife Trusts Wales (OBJ0260)

7.6.1 WTW refer to the views of the Bat Conservation Trust. Please refer to 7.8 below for my response to the BCT’s comments.

7.7 Woodland Trust (OBJ0271)

7.7.1 WT state, “*Light pollution near to ancient woodland is likely to substantially affect the behaviour of species active during dawn and dusk twilight or nocturnal species, such as moths, bats, and certain species of birds, resulting in the decline of some species.*”

7.7.2 The effects of lighting are assessed in sections 10.8.404 to 10.8.406, 10.8.415, 10.8.416, 10.9.266, 10.9.267, 10.9.276, 10.9.277, 10.9.287, 10.9.288 of the March 2016 ES [Document 2.3.2]. It is recognised that

lighting affects bats but lighting along the Scheme is limited and would be designed to minimise spill outside of the road. Refer also to comment at 7.8.6 below, in response to the Bat Conservation Trust on a similar issue.

7.8 Bat Conservation Trust (OBJ0298)

7.8.1 BCT state “*There is no assessment of the impact on bats from noise, traffic and lighting. This is despite the Environmental Statement Volume 3 Appendix 5.1 ES Scoping Report, para 9.7.10, which sets out the effects to be assessed which includes amongst others, ‘disturbance to sensitive species from noise, light, traffic and air pollution’.* There are accredited published academic studies that show that roads have a negative impact on bats and displace bats (and other wildlife) up to 1.5 kilometres away from where bats forage. The most recent report was undertaken by The University of Leeds as part of a report to Defra:
<http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18518>.”

7.8.2 The effects of the operation of the new road on bats are assessed at paragraphs 10.9.262 to 10.9.288 of the March 2016 ES [Document 2.3.2]. The University of Leeds report is cited (*Berthinussen, A. and Altringham, J. (2015). Development of a cost-effective method for monitoring the effectiveness of mitigation for bats crossing linear transport infrastructure WC1060*) and is referred to at length in the March 2016 ES at paragraphs 10.9.263 and 10.9.264 [Document 2.3.2]. Previous work by the same authors (*Berthinussen, A. and Altringham, J. (2012). Do Bat Gantries and Underpasses Help Bats Cross Roads Safely? PLoS ONE 7(6): e38775. Doi:10.1371/journal.pone.0038775*) is referred to in the preceding paragraph of the March 2016 ES.

7.8.3 The assessment considers the potential risk of vehicle collision and the long-term disruption to the movement of bats, in particular those species unlikely to cross the new road, and accepts that the exact level of significance of impact is not possible to estimate as vehicle collision risk cannot be predicted. The magnitude of the potential impact of operation

with no additional mitigation is assessed as moderate adverse and the significance of effects as moderate.

- 7.8.4 The study by Berthinussen, A. and Altringham, J. (2015) reports that roads have a long-term negative impact on bat populations and that the scale of the impact (extending up to 1.6 km either side of a motorway) indicated a barrier effect. They advise that mitigation can remove the barrier and/or remove its impact. In spite of this, even after taking into account additional mitigation, in particular the provision of mammal tunnels adjacent to all reen culverts, the construction of mammal crossings along the route to include locations associated with high bat activity, the detailed alignment of mammal exclusion fencing, and the location of planting to help to lead bats to safe crossing points, on a precautionary basis the magnitude of impact is still assessed as moderate adverse and the significance of effects as moderate. This is a significant impact in EIA terms.
- 7.8.5 BCT state “*The impacts of lighting are also widely published and whilst there is no disagreement about provision of lighting for safety purposes lighting still needs to be carefully considered in the ES at places where bats are likely to be present namely where there is suitable adjacent habitat or connected linear features such as watercourses or hedgerows.*”
- 7.8.6 The effects of operational lighting are considered at paragraphs 10.9.276-277 of the March 2016 ES [Document 2.3.2]. This recognises that road lighting could increase the risk of vehicle collisions for some bat species (such as pipistrelles, serotine and noctules), which are attracted to the insects that can be found around lights, and for some species of bats, such as horseshoe bats, lighting can act as a deterrent affecting commuting, dispersal and population interactions. The March 2016 ES explains that the new section of motorway would be unlit apart from Junctions and their approaches and the River Usk Crossing. It states that in order to minimise the potential impact of operational lighting, where practicable and safe, lighting would take into account best practice recommendations and guidelines published by the Bat Conservation Trust. Where lighting is installed, light fixtures would be directed towards the new road and away

from culverts, mammal crossings, underpasses and overbridges, as well as surrounding habitat of potential value to bats (including areas of woodland, scrub, watercourses and mature trees) and buildings of known or potential value to roosting bats. Commitment 134 in the Register of Commitments states, *'An appropriate lighting strategy would be implemented to avoid lighting of the new section of motorway except at Junctions and river crossings. Lighting of the River Usk and Ebbw crossings would avoid lighting of the river channel'*.

7.8.7 BCT state, *"Lesser horseshoe bat is a key species for Wales and it is particularly sensitive to disturbance and therefore greater consideration should be given to the impact of the road Scheme on this bat species. We note that in Environmental Statement Volume 3 Appendix 10.7 Bat Survey 2014, Chapter 4 a recommendation was made for further survey work to establish the location of their roosts, foraging areas and flight paths but we are unable to find any report on this work."*

7.8.8 The bat survey report at Appendix 10.7 of the March 2016 ES [Document 2.3.2] recommended that further survey work should be undertaken to establish the location of lesser horseshoe bat roosts within the vicinity of any scheme and to establish the main foraging areas and flight paths used by this species. The report stated that it was likely that this would require radio-tracking work to be undertaken and the requirements for this should be discussed with NRW prior to any further surveys being commenced. As explained in the Scope of Ecological Surveys report which is Appendix 9.1 of the EIA Scoping Report, itself Appendix 5.1 to the March 2016 ES [Document 2.3.2], a meeting to discuss further surveys was held with NRW on 30th January 2015. NRW noted that lesser horseshoe bats (LHB) had been recorded in the 2014 activity surveys, and that the implications of this in relation to the Wye Valley SAC (for which LHB is a qualifying feature) would need consideration (i.e. within the scheme AIES). It was agreed that radio-tracking would be unlikely to be practical or successful to locate any LHB roosts (as had been suggested by Arup), but that buildings in the vicinity of Pye Corner would instead need to be searched.

- 7.8.9 Based on this, the work proposed for 2015 was a search of buildings in the vicinity of Pye Corner to look for a potential lesser horseshoe bat roost, along with targeted activity surveys for lesser horseshoe bat in the Pye Corner area and at the underpass north of Magor where there were previous records of the species.
- 7.8.10 As reported in the March 2016 ES at 10.4.259 [Document 2.3.2], in 2014 lesser horseshoe bats were recorded at eight of the 20 locations where static monitoring was undertaken. These were all located to the east of the River Usk between Pye Corner and the eastern end of the study area. These locations were spread out over 9 km and it was therefore concluded that at least two roosts may be present; one near to Pye Corner and Whitson; and one in the area around Magor. The reports of the further 2015 bat surveys were published as Appendices 10.23 and 10.24 of the March 2016 ES [Document 2.3.2] and describe the additional surveys. This included activity surveys at 50 linear features which would be crossed by the new section of motorway, including locations either side of Pye Corner and at underpasses and overbridges north of Magor. Paragraph 10.4.265 of the March 2016 ES reports that lesser horseshoe bats were only recorded in the areas around Magor and Llandevenny in 2015. The levels of lesser horseshoe bat activity in this area were generally comparable with those observed in 2014.
- 7.8.11 Bat roost surveys of buildings were carried out at in 2015 at Pye Corner Farm and Tatton Farm, nearby to the north east. As reported in the March 2016 ES at para 10.453 [Document 2.3.2], bat roosts were identified in these buildings. Only small numbers of common pipistrelles were recorded.
- 7.8.12 Assessment of the value of the corridor of the proposed new section of motorway for bats (paragraph 10.4.272 of the March 2016 ES [Document 2.3.2]) indicated that it is of at least district level importance for lesser horseshoe bats and brown long-eared bats and between district and county level importance for pipistrelles. For all other bat species, results of the surveys indicate that the route is of regional value with regard to foraging and commuting behaviour. Overall the route corridor is thus assessed as

being of regional (medium) value, although, in my opinion this may be an over-valuation for some species, such as greater horseshoe bat (refer to 3.4.3 above).

7.8.13 In addition to the ES it should also be noted that, as a qualifying feature of the Wye Valley and Forest of Dean Bat Sites/Safleoedd Ystlumo Dyffryn Gwy a Fforest y Ddena SAC, the effects of the proposed new section of motorway on lesser horseshoe bat are assessed in the Statement to Inform an Appropriate Assessment {Document 2.3.4} under the Conservation of Habitats and Species Regulations 2010 [Document 3.1.22] published alongside the Draft Orders. Section 5.6 of the Statement to Inform an Appropriate Assessment is concerned with the SAC and considers in detail the effects of the proposed new section of motorway on lesser horseshoe bat (and greater horseshoe bat – also a qualifying feature). The matters considered are:

- a) Direct land take leading to habitat loss/fragmentation of roosts/foraging routes and severance of flight lines (construction);
- b) Physical presence leading to disturbance to species/restriction in movement/ severance of flight lines (construction and operation);
- c) Physical Presence - vehicle collision and increased predation risk (construction and operation);
- d) Noise and vibration leading to disturbance to species (construction and operation);
- e) Lighting has the potential to disturb species/severance flight lines (construction and operation); and
- f) Release of pollutants leading to water quality changes /physiological effects which in turn could affect insect prey populations (construction and operation).

7.8.14 Considering the distance between the Scheme and the SAC and the limited numbers of lesser and greater horseshoe bats recorded in the survey area

during 2014 and 2015, with mitigation, the Scheme would not conflict with the Conservation Objectives of the SAC. It is therefore concluded that there would be no adverse effect on the viability of the SAC bat populations or integrity of the SAC with regard to bats.

- 7.8.15 BCT state, *“Given the likelihood for displacement of all bats arising from the operation of this new road, and the presence of lesser horseshoe bats close to the proposed route, BCT would suggest that the ES is deficient in assessing the impact of the operational phase of the scheme on bats, and lesser horseshoe bats in particular.”*
- 7.8.16 In my opinion, the potential effects on bats have been given proper consideration through the EIA process and also through the parallel assessment under the Habitats Regulations [ref. Document 2.3.4]. This was also further considered in the Draft Bat Mitigation Strategy (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.15]). I disagree that all bats would be displaced. Survey results have shown that some of the highest bat activity areas are close to the existing M4 and common pipistrelle bat maternity roosts have been found at Berryhill Farm and The Conifers, approximately 140 and 300 m from the existing M4 (refer to 3.3). It must also be borne in mind that habitats in the area are already subject to anthropogenic influences, such as noise and lighting, from existing roads, residential and industrial areas, the mainline railway and intensively managed agricultural land. Therefore, bats are either tolerating these influences or may already have been displaced from the area, i.e., existing habitats are not likely to be at full carrying capacity due to the disturbance already caused by humans in the area.

8. Summary and Conclusions

- 8.1.1 My Proof of Evidence concludes that the surveys undertaken for bats have been appropriate and that the assessment of effects on bats is robust. A Draft Bat Mitigation Strategy has been produced (Appendix SS10.5 of the December 2016 ES Supplement [Document 2.4.15]) and will be developed in consultation with NRW at detailed design stage in order to provide the best available mitigation to reduce effects on bats.
- 8.1.2 My Proof of Evidence includes all facts which I regard as being relevant to the opinions which I have expressed and the Inquiry's attention has been drawn to any matter which would affect the validity of that opinion.
- 8.1.3 I believe the facts that I have stated in this Proof of Evidence are true and that the opinions expressed are correct.
- 8.1.4 I understand my duty to the Inquiry to assist it with matters within my expertise and I believe that I have complied with that duty.

9. Figures

9.1 Figure 1. Screenshot from Defra’s Magic Map Application showing distance between Magor Interchange (Junction 23A) and closest part of the Wye Valley and Forest of Dean Bat Sites / Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC

