Welsh Government

M4 Corridor around Newport

Environmental Statement Volume 1

Chapter 10: Ecology and Nature Conservation

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10 Ecology and Nature Conservation

10.1 Introduction

10.1.1 This chapter of the Environmental Statement (ES) sets out the assessment of effects on ecology and nature conservation. The assessment includes the following.

- Sites designated for their nature conservation importance (international, national and local).
- Habitats present.
- Protected or otherwise notable species.

10.1.2 Road schemes can affect biodiversity in various ways. There are a number of areas of potential impact that are relevant to most new road proposals and these include the following.

Effects of Land Take

- Direct loss of wildlife habitats through land take.
- Severance and/or fragmentation where a scheme may create a barrier and divide existing habitats or affect the continuity of wildlife corridors such as hedgerows.

Effects of Construction

- Road construction works can result in disturbance of sensitive species. There is also a risk of water pollution as a result of runoff from construction areas. Although the works are temporary the potential effects can be significant.

Effects of the Operational Road

- Wildlife casualties where animals are killed crossing the road. This can be a particular problem for animals that use traditional routes such as foraging badgers and breeding amphibians. Some birds, such as barn owls, are attracted to road verges by small mammal prey and are vulnerable.
- Disruption of hydrology may affect wetland sites and watercourses.
- Polluted runoff from roads may affect downstream watercourses.
- Road structures such as bridges and embankments, which reduce visibility, may have a deterrent effect on species that prefer large open areas such as large waders and flocks of wildfowl.
- Road lighting can adversely affect invertebrates and disorientate birds.
- Air pollutants from road traffic may affect sensitive species and can result in changes in plant communities.
- Spray from road traffic containing de-icing salt can affect sensitive species. Within about 2 metres (m) of the carriageway a characteristic salt tolerant plant community may develop which in some areas includes species normally found in coastal saltmarshes.

10.1.3 The effects of land take, construction and the operational phase of the Scheme are considered and the significance of the likely ecological and nature conservation effects assessed within this chapter.

10.1.4 An Assessment of Implications (of highways and/or roads projects) on European Sites (AIES) has also been carried out in accordance with the provisions of the Conservation of Habitats and Species Regulations 2010 and following the guidance of the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 4, Part 1 (HD44/09) (Highways Agency, 2009) and is reported separately (Welsh Government, 2016a).

10.2 Legislation and Policy Context

Relevant Legislation

10.2.1 The following relevant UK legislation has been considered within this assessment.

- The Conservation of Habitats and Species Regulations 2010.
- The Countryside and Rights of Way Act 2000.
- Wildlife and Countryside Act 1981 (as amended).
- The Natural Environment and Rural Communities (NERC) Act 2006.
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.
- Eels (England and Wales) Regulations 2009.
- Hedgerows Regulations 1997.
- The Protection of Badgers Act 1992.

10.2.2 EC Directives 2009/147/EC on the Conservation of Wild Birds (the Birds Directive) and 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) are also relevant. These are implemented in the UK principally through the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Habitats and Species Regulations 2010.

10.2.3 The Welsh Government has particular responsibilities with respect to Sites of Special Scientific Interest (SSSIs) under section 28G of the Wildlife and Countryside Act 1981. An authority to which this section applies has the duty of exercising its functions to take reasonable steps, consistent with the proper exercise of those functions, to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which the site is notified as being of special scientific interest.

10.2.4 All wild birds, their nests and eggs are protected under Part 1, Section 1 of the Act. Birds listed in Schedule 1 of the Act are subject to special protection. Wild animals listed in Schedule 5 are protected under Section 9. Plants listed in Schedule 8 are protected under Section 13 of the Act.

10.2.5 The Birds Directive provides a framework for the conservation and management of, and human interactions with, all wild birds in Europe. Birds listed in Annex 1 are afforded special protection.

10.2.6 The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed in the Annexes to the Directive at a favourable conservation status, introducing robust protection for those habitats and species of European importance. Member States are required to take requisite measures to establish a system of strict protection for the animal species listed in Annex IV (a) and plant species in Annex IV (b).

10.2.7 Under Section 40 of the Natural Environment and Rural Communities Act 2006, the Welsh Government must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.

10.2.8 Conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat. The Welsh Government must in particular have regard to the United Nations Environmental Programme Convention on Biological Diversity 1992.

10.2.9 Section 42 of the Act requires the Welsh Government, in consultation with Natural Resources Wales (NRW), to publish and keep under review and revise as appropriate, a list of the living organisms and types of habitat which in its opinion are of principal importance for the purpose of conserving biodiversity.

10.2.10 Without prejudice to the duties under section 40, the Assembly must:

'(a) take such steps as appear to the Assembly to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or

(b) promote the taking by others of such steps.'

10.2.11 The Well-being of Future Generations (Wales) Act 2015 includes a number of well-being goals (Part 2 Section 4), the second of which is 'A resilient Wales' described as:

'A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).'

10.2.12 Part 2 Section 3 of the Act places a well-being duty on public bodies (which include the Welsh Ministers) requiring that:

'(1) Each public body must carry out sustainable development.

(2) The action a public body takes in carrying out sustainable development must include—

(a) setting and publishing objectives ("well-being objectives") that are designed to maximise its contribution to achieving each of the well-being goals, and

(b) taking all reasonable steps (in exercising its functions) to meet those objectives.

……'

10.2.13 The Environment Bill includes measures to provide an integrated natural resource management process to deliver the sustainable management of natural resources. That means the collective actions (including non-action) required for managing the maintenance, enhancement and use of natural resources in a way, or at a rate, which enables people and communities to provide for their social, economic and environmental well-being in Wales.

10.2.14 Public bodies currently have to consider a broad range of environmental data, evidence and advice when making decisions, but this may not always be fully taken into consideration in a timely way. It is intended that the Environment Bill will help to overcome this by introducing a requirement on public bodies to co-operate, share information, jointly plan for and jointly report on the management of natural resources, of which climate resilience and climate mitigation will be a key strand.

10.2.15 Section 6 of the Bill sets out a biodiversity and resilience of ecosystems duty. This enhances the current NERC duty to require all public authorities, when carrying out their functions in Wales, to seek to '*maintain and enhance biodiversity" where it is within the proper exercise of their functions. In doing so, public authorities must also seek to "promote the resilience of ecosystems'*. As under NERC the new duty will apply to a range of public authorities such as the Welsh Ministers, local planning authorities and public bodies. This will ensure that biodiversity is an integral part of the decisions that public authorities take in Wales. It will also link biodiversity with the long term health of ecosystems and the biodiversity duty will align to the framework for sustainable natural resource management in the Bill. The Bill requires all public authorities in Wales to report on the actions they are taking to improve biodiversity and promote ecosystem resilience.

Planning Policy Context

10.2.16 Chapter 6: Legislation and Policy Context provides the overarching and strategic policy context for the Scheme. It briefly describes key legislation and the main planning policies which are relevant to the Scheme at the national level, together with the development planning policies of the local planning authorities which the Scheme runs through. This section identifies the policies which are relevant to ecology and nature conservation.

National Planning Policy

Planning Policy Wales

10.2.17 Planning Policy Wales (PPW) (Welsh Government, 2016b) provides a national policy framework for Wales. Chapter 5 of PPW covers 'Conserving and Improving Natural Heritage and the Coast'. A number of objectives are listed in paragraph 5.1.2 of the document, of which the following are of relevance:

'Promote the conservation of landscape and biodiversity, in particular the conservation of native wildlife and habitats;

Ensure that action in Wales contributes to meeting international responsibilities and obligations for the natural environment;

Ensure that statutorily designated sites are properly protected and managed;

Safeguard protected species, and to

promote the functions and benefits of soils, and in particular their function as a carbon store'.

10.2.18 Paragraph 5.5.1 states that:

'Biodiversity and landscape considerations must be taken into account in determining individual applications and contributing to the implementation of specific projects. The effect of a development proposal on the wildlife or landscape of any area can be a material consideration. In such instances and in the interests of achieving sustainable development it is important to balance conservation objectives with the wider economic needs of local businesses and communities. Where development does occur it is important to ensure that all reasonable steps are taken to safeguard or enhance the environmental quality of land. Pre-application discussions between the developers, local planning authorities and statutory advisers such as Natural Resources Wales are recommended.'

Technical Advice Note 5: Nature Conservation and Planning

10.2.19 Technical Advice Note (TAN) 5 provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation (Welsh Assembly Government, 2009b). The TAN provides advice for local planning authorities on:

- the key principles of positive planning for nature conservation;
- nature conservation and Local Development Plans;
- nature conservation in development management procedures;
- development affecting protected internationally and nationally designated sites and habitats; and
- development affecting protected and priority habitats and species.

Action Plan for Pollinators in Wales

10.2.20 The Action Plan for Pollinators in Wales (Welsh Government, 2013) recognises that:

'Pollinators are an essential component of our environment. Honeybees and wild pollinators including bumblebees, solitary bees, parasitic wasps, hoverflies, butterflies and moths and some beetles are important pollinators in Wales, for crops such as fruit and oil seed rape, clovers and other nitrogen fixing plants that are important to improving the productivity of pasture systems for livestock grazing, and wild flowers.'

10.2.21 It recognises the value of pollination as a contribution to the UK crop market and that bee and pollinator health and declining populations have been increasingly highlighted as a cause for concern in the UK and globally. The Welsh Government has thus worked with industry and stakeholders to look in more detail at the evidence and issues around pollinators and their conservation in Wales. The plan describes the current situation in Wales and identifies areas where action is needed. It details the Welsh Government's Vision for Pollinators in Wales, and puts that into the context of the Welsh Government's priorities and

policies. It also lays out an Agenda for Action comprising the outcomes and areas for action that have been identified and how the Welsh Government will work towards them.

Local Planning Policy

10.2.22 The Scheme lies within the administrative areas of Newport City Council and Monmouthshire County Council. For the purposes of the ecology and nature conservation assessment, relevant policies from these local planning authorities have been considered. In addition, policies from the adjacent administrative area of Cardiff City Council have been considered. The relevant polices are set out in full at Appendix 10.1. The assessment has had regard to the following local policy documents. It should be noted that whilst these documents provide context, they are not determinative.

10.2.23 Relevant local planning policies from the following documents have been considered in the assessment.

- Newport Local Development Plan 2011-2026 (Newport City Council, 2015a).
- Monmouthshire Local Development Plan 2011-2021 (Monmouthshire County Council, 2014).

10.2.24 Newport City Council has also published the River Usk Strategy (Newport City Council, 2009), and Wildlife and Development Supplementary Planning Guidance (SPG) (Newport City Council, 2015b), the relevant recommendations of which been taken into account.

10.2.25 The City of Cardiff Council has recently adopted its Local Development Plan (LDP) for the period up to 2026 (Cardiff City Council, 2016).

10.2.26 The planning policies relevant to ecology and nature conservation are set out in Appendix 10.1. The key relevant policies are set out below.

Newport Local Development Plan 2011-2026

10.2.27 Objective 6 – Conservation of the Natural Environment of the Plan is:

'To protect and enhance the quality of the natural environment, including landscape, protected habitats and species of principal importance for biodiversity in Wales (regardless of greenfield or brownfield status) and the protection of controlled waters.'

10.2.28 The key policies relevant to ecology and nature conservation are:

- SP5 Countryside;
- SP9 Conservation of the Natural, Historic and Built Environment;
- CE8 Locally Designated Nature Conservation and Geological Sites; and
- CE9 Coastal Zone.

10.2.29 Newport City Council's River Usk Strategy includes a section on Ecological Interests and Opportunities (Section 6). This describes the ecological designations of the river, including the qualifying features of the River Usk Special Area of Conservation (SAC); the requirements for Habitats Regulations Assessments, European Protected Species; the Newport Urban Otter Habitat

Survey - Phase 2; development in the vicinity of the river; ecological opportunities; and consultations with relevant organisations.

10.2.30 The key recommendations of this section of the strategy are as follows.

- *'To continue to work closely with the Environment Agency and Countryside Council for Wales to ensure that future proposals or plans do not adversely affect the nature conservation features of the River Usk.*
- *To comply with the Conservation (Natural Habitats &c) Regulations 1994 and carry out Habitats Regulations Assessments to ensure that development does not have a detrimental impact upon the Special Area of Conservation or the special features for which it was designated.'*

Monmouthshire Local Development Plan 2011-2021

10.2.31 The Plan recognises that:

'Monmouthshire has major biodiversity and landscape resources that need to be preserved and should be protected, managed and enhanced.

There is a need to improve connectivity within the landscape through protecting and improving existing wildlife networks and corridors and creating new linkages to allow species to move and adapt to climate change impacts.'

10.2.32 The LDP seeks to influence these issues through a range of measures, those relevant to ecology and nature conservation being:

'Ensuring that new development does not cause harm to international, national and locally protected sites and species and that where appropriate and necessary, avoidance, mitigation and compensation measures are incorporated, while ensuring that new benefits for Biodiversity are explored.

Undertaking a Habitats Regulations Assessment to ensure that the cumulative effects of development in Monmouthshire and adjoining areas do not result in harm to internationally designated nature conservation sites.

Ensuring that biodiversity is considered in any development in order to protect any existing interest on the site and encourage biodiversity enhancements where necessary.'

10.2.33 The relevant Objective - Valuing our Environment - of the plan is:

'8. To protect, enhance and manage Monmouthshire's natural heritage, including the Wye Valley AONB, the County's other high quality and distinctive landscapes, protected sites, protected species and other biodiversity interests and the ecological connectivity between them, for their own sake and to maximise benefits for the economy, tourism and social well-being.'

10.2.34 The key policies relevant to ecology and nature conservation are:

- Policy S13 – Landscape, Green Infrastructure and the Natural Environment.
- Policy NE1 – Nature Conservation and Development.

City of Cardiff Local Development Plan (2016)

10.2.35 One of the objectives of the plan under broad objective 3: To deliver economic and social needs in a co-ordinated way that respects Cardiff's environment and responds to the challenges of climate change is:

'To protect, manage and enhance Cardiff's natural environmental assets, including:

…

The city's biodiversity, its internationally, nationally and locally designated sites, wildlife habitats and features that contain important species and networks that link together areas of value;

…'

10.2.36 Key Policy KP16: Green Infrastructure states that:

'Cardiff's distinctive natural heritage provides a network of green infrastructure which will be protected, enhanced, created and managed to ensure the integrity and connectivity of this multi-functional green resource is maintained.

Protection and conservation of natural heritage network needs to be reconciled with the benefits of development. Proposed development should therefore demonstrate how green infrastructure has been considered and integrated into the proposals. If development results in overall loss of green infrastructure, appropriate compensation will be required.

Natural heritage assets are key to Cardiff's character, value, distinctiveness and sense of place. They include the city's:

i. Undeveloped countryside and coastline (EN1 and EN2);

…

iv. Biodiversity interests including designated sites and the connectivity of priority habitats and species (EN5, EN6 and EN7);

v. Trees (including street trees), woodlands and hedgerows (EN8);

…'

10.2.37 The relevant policies of the plan are:

- EN1: Countryside Protection;
- EN5: Designated Sites;
- EN6: Ecological Networks and Features of Importance for Biodiversity;
- EN7: Priority Habitats and Species; and
- EN8: Trees, Woodlands And Hedgerows.

Biodiversity Action Plans and Management Plans

10.2.38 The following Biodiversity Action Plans are relevant to the assessment.

- UK Post-2010 Biodiversity Framework (Joint Nature Conservation Committee, 2012).
- Newport Local Biodiversity Action Plan (Newport Biodiversity Partnership, 2014).
- Monmouthshire Local Biodiversity Action Plan (LBAP) (Monmouthshire County Council, 2005).
- Trunk Road Estate Biodiversity Action Plan 2004-2014 (Welsh Assembly Government, 2004).

10.2.39 The UK Post-2010 Biodiversity Framework supersedes the UK Biodiversity Action Plan. In 2007 the UK Biodiversity Partnership published an updated list of priority UK species and habitats covering terrestrial, freshwater and marine biodiversity to focus conservation action for rarer species and habitats in the UK. The UK priority list contains 1150 species and 65 habitats. The UK list has been used as a reference to draw up the species and habitats of principal importance in Wales under Section 42 of the NERC Act.

10.2.40 The Newport and Monmouthshire Biodiversity Action Plans contain Habitat Action Plans and Species Action Plans for some of the habitats and species recorded within the study area as does the Trunk Road Estate Biodiversity Action Plan. These have been taken into account in this assessment.

10.2.41 Selection of non-statutory sites of local wildlife importance is an important tool for conservation of local biodiversity enabling the planning system to recognise and thus protect or enhance areas of substantive nature conservation value outside the limited network of statutorily protected SSSIs. The Guidelines for the Selection of Wildlife Sites in South Wales (The South Wales Wildlife Sites Partnership, 2004) set out a common set of guidelines for the selection of Wildlife Sites in the South Wales region. Similar guidance for the whole of Wales is provided in the Guidelines for the Selection of Wildlife Sites in Wales (Wales Biodiversity Partnership, 2008).

10.2.42 Sites of Importance for Nature Conservation (SINCs) designated on the basis of these guidelines are identified in this chapter and the effects of the Scheme on them are assessed.

10.2.43 An important initiative in conservation of biodiversity in the Gwent Levels is the Living Levels Project. The partners in the project are the Royal Society for the Protection of Birds (RSPB), Gwent Wildlife Trust (GWT), Natural Resources Wales (NRW), Newport City Council (NCC), Monmouthshire County Council (MCC), Cardiff City Council (CCC), Rick Turner OBE, Cardiff Story Museum, Sustrans, National Trust, Bumblebee Conservation Trust and Buglife.

10.2.44 The project has been awarded funding of £2,865,300 through the Heritage Lottery Fund's Landscape Partnership programme, which provides grants for schemes aiming to conserve areas of distinctive landscape character. The project plans to work with volunteers, farmers and communities to collectively increase wildlife-friendly management, provide interpretation and create new trails, increasing people's awareness of the area's unique features.

10.2.45 The initial development period of the project will run from January 2016 to June 2017. Subject to successful completion of the development stage, the delivery stage of the project would run from the end of 2017 to the end of 2020.

10.2.46 In addition, the following management plans are considered relevant to the assessment.

- Wye and Usk Catchment Flood Management Plan (Environment Agency, 2010).
- Draft Shoreline Management Plan for the Severn Estuary (SMP2) (Severn Estuary Coastal Group, 2010).
- Severn Estuary Flood Risk Management Strategy (SEFRMS) (Environment Agency, 2014)

10.2.47 These plans set out the policies governing how catchment and coastal flood protection would be managed in the area and hence the future conditions which will prevail when the new road is operational.

10.3 Assessment Methodology

Relevant Guidance

10.3.1 In addition to the policy documents, action plans and management plans set out in Section 10.2 above, the following relevant guidance has been taken into account during the assessment.

- Guidelines for Ecological Impact Assessment in the UK Chartered Institute of Ecology and Environmental Management (CIEEM, 2006).
- Guidelines for Baseline Ecological Assessment (Institute of Environmental Assessment, 1995).
- Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 5, HA 205/08: Assessment And Management Of Environmental Effects (Highways Agency, 2008a).
- Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 4: Ecology and Nature Conservation (Highways Agency, 1993).
- Interim Advice Note 116/08 (W) Nature Conservation in Relation to Bats (Welsh Assembly Government, 2009a).
- Interim Advice Note 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment (Highways Agency, 2010).
- Technical Advice Note (TAN) 5: Nature Conservation and Planning (Welsh Assembly Government, 2009b).
- Welsh Transport Planning and Appraisal Guidance: WelTAG (Welsh Assembly Government, 2008).

10.3.2 In January 2016, CIEEM issued Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition (CIEEM, 2016) which updates CIEEM (2006). However, this was too late to be considered for the purposes of this ES chapter.

Study Area

10.3.3 In accordance with the relevant guidance, an ecology desk study has been undertaken to identify records of designated sites and protected habitats or species. The study area for the desk study for the Scheme extended to 30 km for Special Areas of Conservation designated for bats, 10 km for other internationally designated sites, 5 km for nationally designated sites such as SSSIs and 1 km for locally designated SINCs.

10.3.4 For protected species the study area extended to 2 km (other than for bats for which it was extended to 5 km). For other species of conservation concern, the study area extended to 1 km.

10.3.5 For ecology surveys undertaken during 2014, the study area was generally based on an area extending to 500 m around the physical extent of an earlier similar scheme alignment, including the route alignment, potential junctions and water treatment areas. The alignment that forms part of the current Scheme and is assessed within this ES is shown on Figures 1.1 and 2.4 and is located within this previous study corridor.

10.3.6 The 2015 surveys have been based on the current Scheme and have targeted areas not previously surveyed to complete the survey scope in order to inform the assessment. The proposals for these surveys were set out in the Scope of Ecology Surveys report which formed Appendix 9.1 to the EIA Scoping Report (ES Appendix 5.1). This report summarised the survey work previously carried out by Arup in 2014 and made recommendations regarding the further surveys required to support the EIA. In doing so it had regard to a previous discussion of the scope of further surveys set out in the note of a meeting between NRW and Hyder (as the Welsh Government's ecological advisor) on 30th January 2015 (the note of which is at Appendix A of the Scope of Ecology Surveys report).

10.3.7 The report was prepared in order to assist in the consultation with NRW in order that the scope of further surveys could be agreed and it was finalised following discussions with Hyder and NRW.

10.3.8 Further information on discussions with NRW is set out under the heading Consultation later in this section.

Complementary Measures

10.3.9 In addition to the new section of motorway, the Scheme would incorporate Complementary Measures, including the following.

- Improvements to safety, access arrangements and the ability to manage traffic by reclassifying the existing M4 between Magor and Castleton as a trunk road.
- Relief to Junction 23A of the existing M4 and the local road network with a new M4/M48/B4245 connection (described within Section 2.3 above)
- Providing cycle and walking friendly infrastructure.

10.3.10 The existing M4 would be reclassified to take the form of an all-purpose trunk road. The existing number and widths of lanes would be maintained, with the exception of the following.

- From Junction 23A to Junction 24 the cross section would be reduced to two lanes in both directions. The existing Lane 1 and hard shoulder would be hatched out of use by road markings.
- From Junction 24 to Junction 25, the cross section on the westbound carriageway would be reduced to two running lanes. The existing Lane 1 would be hatched out of use by road markings. The eastbound carriageway would have three lanes to accommodate climbing vehicles on the steep gradient of St Julians Hill.
- Through Junction 28, the cross section would be reduced to two lanes in both directions. The existing Lane 1 and hard shoulder would be hatched out of use by road markings.

10.3.11 Further details are provided in Chapter 2: Scheme Description.

10.3.12 These measures would not require any additional land take over and above that required for the new section of motorway.

10.3.13 Given the nature of the works proposed, and the limited potential for ecological impacts as a result of these proposals, no ecology surveys were carried out in relation to the Complementary Measures beyond those carried out for the new section of motorway.

Approach to Identification of Baseline Conditions

Desk Study

10.3.14 A desk study was carried out by Arup in 2013 comprising a biodiversity information search from the South East Wales Biological Records Centre (SEWBReC) to inform and support the ecological survey methodology. The desk study is included in the Extended Phase 1 Habitat Survey Report (Appendix 10.2). This included records of bats up to 5 km, other legally protected and priority species within 2 km, and species of conservation concern within 1 km of the study area at that time.

10.3.15 This desk study was updated by RPS in 2015 and extended to include the section of the existing M4 for which Complementary Measures are proposed as part of the Scheme. Further details of the methodology and the findings of the desk study are provided at Appendix 10.17. Confidential Desk Study data are provided in Appendix 10.36.

10.3.16 As part of the desk study, RPS has also reviewed additional NRW invertebrate survey reports for the Gwent Levels.

Previous Surveys

10.3.17 The previous surveys, which were carried out on behalf of the Welsh Government in 2014 by or for Arup, have informed the description of the baseline conditions and comprise the following (reports at Appendices 10.2, 10.4 to 10.15 and 10.37).

- Extended Phase 1 Habitat Survey.
- National Vegetation Classification (NVC) Survey.
- Hedgerow Survey.

- Great Crested Newt Presence/Absence Surveys.
- Bat Activity Survey.
- Otter and Water Vole Survey.
- Dormouse Survey.
- Full Badger Survey.
- Hedgehog Survey.
- Reptile Survey.
- Wintering Bird Survey.
- Breeding Bird Survey.
- Aquatic Macrophyte Survey.
- Invertebrate Survey.

10.3.18 In addition to these surveys, Hyder carried out a survey of wintering birds over the winter of 2014/2015 and this is reported in the Wintering Bird Survey Report 2015 (Appendix 10.16).

10.3.19 Verification and review of these previous survey reports has been undertaken to identify gaps in the survey coverage (largely as a result of lack of access to land at the time of survey). In the case of some surveys, the findings of the Arup reports themselves gave rise to the need for additional surveys. Further surveys were therefore carried out in 2015 by RPS (or subconsultants commissioned by RPS) in order to inform the assessment of the Scheme.

10.3.20 Surveys undertaken by or for RPS in 2015 are as follows (Appendices 10.18 to 10.33 and 10.38).

- Extended Phase 1 Habitat Survey.
- National Vegetation Classification Survey.
- Hedgerow Survey.
- Great Crested Newt eDNA Survey.
- Bat Activity Surveys.
- Bat Roost Surveys.
- Otter Survey.
- Water Vole Survey.
- Dormouse Survey.
- Badger Survey.
- Reptile Survey.
- Breeding Bird and Breeding Wader Surveys.
- Barn Owl Survey.
- Aquatic Macrophytes Survey.
- Terrestrial Invertebrate Surveys.
- River Corridor Survey.

- Wax Cap Survey.

10.3.21 The following sections summarise the studies and surveys that have been undertaken to inform the assessment of the Scheme.

Extended Phase 1 Habitat Survey

10.3.22 The objectives of the Arup Phase 1 habitat survey carried out in 2014 (Appendix 10.2) were to:

- identify and map the broad habitat types present within the study area;
- record signs of legally protected species and non-native invasive plant species; and
- assess the suitability of habitats within the study area to support legally protected and otherwise notable species.

10.3.23 The 2014 survey methodology followed the 'extended Phase 1' methodology as set out in Guidelines for Baseline Ecological Assessment (Institute of Environmental Assessment, 1995). This method of survey provides information on the habitats in the survey area and the potential for legally protected species to occur on or adjacent to the site. The survey was carried out within the optimum survey window, which extends from March-October.

10.3.24 The habitats were classified according to their vegetation types and presented in the standard Phase 1 habitat survey format (JNCC, 2010). Species composition of areas of particular interest, including those with potential for protected species to be present, were recorded.

Further Survey

10.3.25 Further extended Phase 1 habitat survey was carried out by RPS in 2015 for those areas within 250 m of the new section of motorway not previously accessible to Arup, or where additional areas required survey as a result of changes to the study area. This included, for example, additional areas at the eastern end of the Scheme along the proposed haul road connecting to Ifton Quarry. Further details of the methodology and the findings of the 2015 Phase 1 Habitat Survey are provided at Appendix 10.19.

National Vegetation Classification

10.3.26 A National Vegetation Classification (NVC) survey of selected areas was undertaken by Peter Sturgess on behalf of Arup in 2014 (Appendix 10.4) and covered the following sites.

1 Pound Hill - grassland.

2 Berryhill Farm - woodland.

3 Great Pencarn, Duffryn - derelict land with grassland and scrub.

4 Fox Covert - scrub.

5 Lighthouse Road - grassland.

6 New Dairy Farm - grassland.

7 Ebbw - seawall and saltmarsh.

8 Usk - saltmarsh.

9 Solutia Brownfield - scrub and grassland.

10 Broad Street Common - grassland and scrub.

11 Green Moor brownfield land - grassland and scrub.

12 Green Moor fields - grassland.

13 Greenmoor Lane - grassland.

14 Magor Road - grassland and woodland.

10.3.27 The survey was generally undertaken by walking through each site to examine and map the main vegetation types. The plant communities were plotted by eye onto an aerial photograph base plan. Photographs were also taken to illustrate the main vegetation types.

10.3.28 The vegetation was delineated into approximately homogeneous stands of vegetation for mapping purposes. The plant communities of these stands were then examined in more detail by quadrat sampling, and described in terms of the published NVC communities (Rodwell, 1991 *et seq*.).

Further Survey

10.3.29 A further NVC survey using the same methods was carried out by Peter Sturgess for RPS in 2015 (Appendix 10.20) covering additional areas as follows.

- Area A: Semi-improved neutral grassland and woodlands north of Castleton.
- Area B: Woodland at Pound Hill.
- Area C: Semi-improved neutral grassland east of Tredegar Park.
- Area D: Brownfield land within Newport Docks and saltmarsh on the east bank of the River Ebbw.
- Area E: Woodland at Pye Corner.
- Area F: Semi-improved neutral grassland and marshy grassland at Tatton Farm east of Queen's Meadow Industrial Estate.
- Area G: Woodland adjacent to proposed Ifton Quarry Haul Road.
- Area H: Reedbeds and other habitats within Tata Steel land at Llanwern.

10.3.30 Further details of the methodology and the findings of the 2015 NVC survey are provided at Appendix 10.20.

10.3.31 The 2015 NVC survey identified that grassland at Pound Hill and Pwll Diwaelod had the potential to support waxcap fungi. A survey for waxcaps in these areas was carried out by Peter Sturgess in Autumn 2015. Details of the methodology and findings of the survey are provided in the report at Appendix 10.33.

Hedgerows

10.3.32 A hedgerow survey was undertaken by Arup in 2014 to identify attributes set out in the Hedgerows Regulations 1997 (Appendix 10.5).

10.3.33 The hedgerows were assigned to categories that provide a description of the hedgerow, so as to standardise recording and to inform the final assessment of

hedgerow importance. These categories were based on descriptions given in the Hedgerow Survey Handbook (Defra, 2007) as follows:

- managed 'gappy' hedgerow;
- intact managed hedgerow;
- unmanaged hedgerow;
- hedgebank with occasional shrubs;
- managed hedgerow with mature trees;
- treeline;
- new/reinstated hedgerow; and
- fenceline.

10.3.34 An assessment of hedgerow importance was conducted using all the available information, including information on public rights of way obtained from Ordnance Survey data.

Further Survey

10.3.35 RPS undertook a further survey of hedgerows in 2015 (Appendix 10.21) in areas where access for surveys was not previously available. In these areas, hedgerows identified as potentially important through the further Phase 1 habitat survey and which would be directly affected by the proposed new section of motorway were targeted. A total of forty eight hedgerows was included in the 2015 hedgerow survey

10.3.36 Further details of the methodology and the findings of the hedgerow survey are provided at Appendix 10.21

Great Crested Newt

10.3.37 Initial Habitat Suitability Index (HSI) assessments of waterbodies within the study area that could be assessed from roads and public rights of way were undertaken by Arup during February 2014 (included in the Extended Phase 1 Habitat Survey Report at Appendix 10.2). These assessments were made in accordance with the methodology set out in Advice Note 5 published by the Amphibian and Reptile Group UK (ARGUK, 2010).

10.3.38 The results of the HSI surveys were used to identify waterbodies considered to have average or above average suitability for great crested newts, which were selected for presence/absence surveys where access allowed. The 2014 presence/absence surveys covered a small area due to access limitations.

Further Survey

10.3.39 In 2015, RPS commissioned Thomson Ecology to undertake further survey of waterbodies (Appendix 10.22). These surveys used the eDNA technique in areas that fell within 250 m of the proposed new section of motorway where the Arup HSI assessments identified waterbodies of average or higher suitability. These areas were considered to be those where great crested newt was most likely to be present.

10.3.40 Seven survey areas were identified which contained the highest concentrations of waterbodies with average or higher than average HSI scores. All waterbodies within each of the survey areas were surveyed including those with an HSI score of below average or poor due to their close proximity to waterbodies with a higher score. This resulted in a total of 396 waterbodies being identified for survey out of the total of 928 waterbodies within the 250 metre zone. Of these, 73 waterbodies were found to not provide suitable habitat for great crested newts at the time of the survey because they were dry. A further 37 waterbodies were not surveyed because they were inaccessible, either due to barriers preventing access or due to health and safety reasons. Three waterbodies were no longer found to exist where they had been mapped. Thus water samples were taken for analysis from a total of 283 waterbodies during May and June 2015.

10.3.41 In any areas where great crested newt presence was indicated by the eDNA technique, where necessary, population assessment will be carried out in 2016 by conventional survey techniques to further inform appropriate mitigation and the Method Statement to support any European Protected Species application.

10.3.42 Further details of the methodology and the findings of the 2015 great crested eDNA newt survey are provided at Appendix 10.22.

Bats

Roosting Bats

10.3.43 During the course of the Arup extended Phase 1 habitat survey (Appendix 10.2), trees and buildings were assessed for their potential to support bat roosts in line with the Good Practice Survey Guidelines published by the Bat Conservation Trust (Hundt, 2012). Trees within the study area were assessed for the presence of natural holes, woodpecker holes, cracks and splits, loose bark, cavities, and artificial bat boxes.

10.3.44 The presence of such features was considered in determining the potential for bat roosts to be present and assigning trees in accordance with their potential to support bat roosts as follows.

Table 10.1: Categories Used in Assessing Trees for Bat Roosting Potential

Tree Category	Description
Known roost	Signs of bat activity indicating that the feature is a bat roost.
1*	Trees with multiple, highly suitable features capable of supporting larger roosts.
1	Trees with definite bat potential, supporting fewer suitable features than category 1* trees or with potential for use by single bats.
2	Trees with no obvious potential, although the tree is of a size and age that suitable features may be present, or trees which have limited potential to support bats.
3	Small, young trees, or trees with no suitable features to support bat roosts.

10.3.45 Buildings were also categorised as being of high, medium or low potential for bats depending on the construction of the building and the presence of potential bat access points ascertained by external inspections, if necessary, using binoculars and torches.

10.3.46 Within the 2014 Arup preliminary bat roost assessment (Appendix 10.7) 109 trees within the survey area were classified as having high bat roost potential. Of these, 36 trees and one group of five trees were within or adjacent to the footprint for the new section of motorway at that time.

Further Survey

10.3.47 In 2015, RPS and Thomson Ecology undertook ground level and, where necessary, climbing inspections of the relevant trees (Appendix 10.24). These were followed, where appropriate, by emergence surveys of tree roost locations with high potential and inspections within the footprint of the new section of motorway or within 100 m.

10.3.48 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. These were at the Fair Orchard Farm, ABP workshops in Newport Docks, Pye Corner Farm, Tatton Farm and the Vicarage at Magor. Tatton Farm, Pye Corner Farm and the Vicarage were particularly targeted for their potential for lesser horseshoe bat roosts as the species had been recorded in these areas.

10.3.49 Further details of the methodology and the findings of the 2015 bat roost surveys are provided at Appendix 10.24

Bat Activity Surveys

Walked Activity Transect Surveys

10.3.50 Walked activity transects were undertaken by Arup in 2014 (Appendix 10.7) in line with good practice guidelines (Hundt, 2012). Species identification was undertaken following the transects using a combination of different software packages designed for analysing and identifying bat calls.

10.3.51 No further walked transect surveys were carried out by RPS in 2015.

Static Bat Activity Monitoring

10.3.52 In 2014 Arup undertook static detector activity surveys (Appendix 10.7) in accordance with good practice guidelines (Hundt, 2012). Locations were selected using professional judgement, and correspondence with NRW, to provide a representative sample of the different habitats present along the new section of motorway and to provide information on areas of known bat activity identified in previous surveys undertaken in 2008.

Further Survey

10.3.53 In 2015, RPS and Thomson Ecology carried out further static detector surveys of linear features that would be crossed by the new section of motorway to determine the need for safe crossing points and to provide a baseline for future monitoring. A total of fifty such locations were selected along the proposed route. The locations were selected on the basis of the 2014 surveys and the 2014 and 2015 desk studies and using professional judgement. The locations selected included hedgerows, woodland edges and the margins of reens.

10.3.54 In addition to the static bat detector surveys, bat activity surveys were undertaken at five underpasses and two road bridges which cross the existing M4 to

determine whether these are used as a commuting routes by bats (and in particular lesser horseshoe bats).

10.3.55 Initially bat species were automatically identified from recordings using Kaleidoscope Pro Software. However, as Kaleidoscope automatic identification cannot be relied upon entirely, particularly for species other than pipistrelles, files produced by the processing were then reviewed to ensure correct identification of species and to identify where possible any bat species that could not be recognised by the software.

10.3.56 In 2014, this manual verification process excluded calls identified as being either common or soprano pipistrelle, except where high levels of insect noise had resulted in uncertainty over the accuracy of identification. All other calls were checked by an appropriately experienced ecologist. Data were included for the first five nights of recording each month; however, where rarer or more notable species had been recorded on any additional nights, the species were included in terms of species diversity.

10.3.57 For the 2015 data, all calls recorded at the first 10 sm2 locations were manually verified, including pipistrelles, in order to check confidence in the Kaleidoscope auto-identification. Following this confidence test, for all other locations, 5% of all auto-identified common and soprano pipistrelle calls (those scored with the least confidence of being correct species match) were manually verified. If a high proportion of these were found to be incorrectly auto-identified, all pipistrelle calls recorded at that location were manually verified. All other species and sound files were manually verified by appropriately experienced ecologists. Because of the difficulty of identifying *Myotis* species, bat calls from the *Myotis* genus were grouped together and manually labelled as *Myotis* species.

10.3.58 Further details of the methodology and the findings of the 2015 bat activity surveys are provided at Appendix 10.23.

Otter

10.3.59 Otter surveys were undertaken by Arup (Appendix 10.8) using survey methods adapted from authoritative sources and best practice survey guidelines (Chanin, 2003; and Crawford, 2003).

Presence/Absence Survey

10.3.60 Field signs of otters were searched for, including spraints, anal jelly, holts, laying–up sites, bank slides, runs, tunnels, prey remains and footprints. Features that have high potential to be attractive to otters were also examined, including suitable bridges, bases of large trees, dense vegetation, crossings, confluences of waterbodies, culverts and boulders.

Habitat Suitability Assessment

10.3.61 Habitat suitability assessments were carried out at each waterbody/watercourse visited with sites subsequently defined as being of high, moderate or low suitability.

Camera Traps

10.3.62 At locations where fresh footprints or fresh spraint had been recorded adjacent to optimal habitat for otters, camera traps were set up to record activity.

Further Survey

10.3.63 In 2015, RPS undertook further surveys for signs of otter in those areas within 100 m of the footprint of the new section of motorway to which access was not previously possible. Further details of the methodology and the findings of the 2015 otter surveys are provided at Appendix 10.25.

Water Vole

10.3.64 Water vole surveys were undertaken in 2014 by Arup (Appendix 10.8) using a survey method based on the best practice survey guidelines in the Water Vole Conservation Handbook (Strachan *et al.,* 2011).

Presence/Absence Survey

10.3.65 At each waterbody, a search for the following field signs was undertaken: faeces, latrines, feeding stations, burrows, footprints. Droppings are the most distinctive field sign to indicate recent use of a waterbody by water voles (Strachan *et al.*, 2011). A thorough search of the bankside vegetation was performed at each waterbody until a latrine was found, thereafter point checks were performed.

Habitat Suitability Assessment

10.3.66 Habitat suitability assessments were carried out at each waterbody/watercourse visited with sites subsequently defined as being of high, moderate or low suitability.

Further Survey

10.3.67 In 2015, RPS undertook further surveys for signs of water vole in those areas within 100 m of the footprint of the new section of motorway to which access was not previously possible. Further details of the methodology and the findings of the 2015 water vole surveys are provided at Appendix 10.25.

Dormouse

10.3.68 The Arup survey work in 2014 utilised a combination of survey methods as recommended in the DMRB Volume 10, Section 4, Part 6 (Highways Agency, 2001a). The surveys also followed the methodology set out in the Dormouse Conservation Handbook (Bright *et al.,* 2006). The surveys comprised searches for gnawed hazel nuts (where hazel was present); searches for other evidence of dormice, such as nests; and the placement and monitoring of nest tubes in discrete areas to record dormouse presence (Appendix 10.9). The areas surveyed were selected taking into account the habitat preferences of the species and previous dormouse records.

Hazel Nut Searches

10.3.69 Within areas of suitable habitat where fruiting hazel trees were present, searches for hazelnuts characteristically chewed by dormouse were made in 2014. This survey technique readily establishes dormouse activity within an area.

Nest Tube Survey

10.3.70 Surveys consisted of putting nest tubes in areas of woodland and suitable hedgerows within the survey area. As set out in the DMRB Volume 10, Section 4, Part 6 (Highways Agency, 2001a), tubes were installed during April/May 2014 and left *in situ* during the active season (May until November) in shrubs, hedgerows and trees. These were checked monthly for the presence of dormice and recently constructed dormouse nests.

Further Survey

10.3.71 In 2015, RPS continued monitoring of the dormouse tubes in the Castleton area where dormouse had been recorded. In addition the survey was extended into connected hedgerows to further investigate the distribution of dormouse in this area. The surveys commenced by Arup within the Gwent Levels were also continued (and extended, where necessary).

10.3.72 Further dormouse survey was also carried out at the eastern end of the Scheme to the north east of the Magor junction and at the eastern end of the proposed Ifton Quarry haul road.

10.3.73 Further hazelnut searches were carried out in suitable habitat.

10.3.74 Further details of the methodology and the findings of the 2015 dormouse surveys are provided at Appendix 10.26.

Badger

10.3.75 The Arup 2014 badger survey methodology (Confidential Appendix 10.37 followed best practice and standard guidance (Highways Agency, 2001b). Surveys sought to determine the presence of badgers and make note of indications of their activity by identification of the locations of setts, latrines, footprints and paths. Within the survey area, field boundaries, reen banks, ditch banks, woodlands and other features with potential to be used by badgers were given particular attention.

10.3.76 All badger setts that were found were assessed and classified into categories according to the level of use evident and the number of entrance holes present. Categories of use and their defining characteristics included main sett, annexe sett, subsidiary sett, and outlying sett.

10.3.77 In addition to classifying each sett, the number of entrances was counted and their status recorded.

Further Survey

10.3.78 In 2015, RPS undertook badger surveys in areas which would be affected by the new section of motorway where access was not previously possible in 2014. The

survey also included an update of the status of setts identified in 2014 that were likely to be affected by the proposed new section of motorway.

10.3.79 Further details of the methodology and the findings of the 2015 badger surveys are provided at Confidential Appendix 10.38

Hedgehog

10.3.80 Arup carried out a survey for hedgehog in 2014. The National Hedgehog Survey (Mammal Society, 2012) method was used for the survey, although it was adapted to determine presence/absence only rather than abundance. Further details of the methodology and the findings of the hedgehog survey are provided at Appendix 10.10.

10.3.81 The survey involved the use of footprint tunnels, ink, paper and bait to record animal track and prints. Tunnels were placed along the route corridor in areas that may be suitable for hedgehogs. Surveys were carried out in May and September 2014 over periods of five consecutive days.

10.3.82 On the basis of the desk study and survey findings it was assumed that hedgehogs are likely to be present throughout the study area and no additional hedgehog surveys were carried out in 2015.

Reptiles

10.3.83 Arup undertook a reptile survey in 2014 (Appendix 10.11). A representative sample of habitats was selected based on the results of desk study records, previous survey information and assessment of habitat quality/potential from the Phase 1 habitat surveys undertaken for the new section of motorway.

10.3.84 The methodology used in the survey followed standard guidance for reptile surveys (Froglife, 1999). The methodology involved the placement of artificial refugia within suitable areas of habitat for reptiles. Areas of suitable reptile habitat were targeted for survey and included south facing slopes, areas of short vegetation close to scrub and suitable hibernation habitat including rubble/wood piles and mounds of crushed aggregate where present.

Further Survey

10.3.85 In 2015, RPS undertook additional reptile surveys in two areas within and adjacent to the new section of motorway. These were:

- an area of brownfield land within the ABP estate at Newport Docks which was not previously accessible; and
- along a south facing bank of the Tata Steelworks former lagoons.

10.3.86 Further details of the methodology and the findings of the 2015 reptile surveys are provided at Appendix 10.27.

Wintering Birds

10.3.87 The survey methods followed in the winter of 2013/2014 by Arup (Appendix 10.12) were derived from current best practice as described in Bird Census Techniques (Bibby *et al.*, 2000) and Bird Monitoring Methods (Gilbert *et al.*, 1998). The main focus of the surveys was to record the presence of bird species

listed as features of the nearby Severn Estuary Special Protection Area (SPA) and Ramsar Site.

10.3.88 Three survey visits were carried out between January and March 2014. Walkover surveys were carried out during the day, starting in the morning and aimed to be completed within four hours around the time of high tide following the Wetland Bird Survey (WeBS) Core Count methodology (British Trust for Ornithology, 2012).

10.3.89 These surveys consisted of surveying all areas accessible from roads and public rights of way and any areas in which land access had been agreed within the study area. Within these areas, the number of birds of each species encountered in each field was recorded. The main focus of the surveys was to record the presence of bird species listed as features of the nearby Severn Estuary Special SPA and Ramsar Site (target species).

10.3.90 Four hour vantage point (VP) surveys were carried out in January, February and March 2014 at the locations of the proposed crossings of the River Usk and the River Ebbw, giving a total of 12 hours of survey at each site. These surveys were undertaken around the time of low water and aimed to identify the presence of target species foraging within the intertidal areas, and to identify the pattern of movement of birds up and down these rivers during the low water period.

Further Survey

10.3.91 Further winter bird surveys were carried out by Hyder Consulting in winter 2014/2015 (Appendix 10.16). The methodology sought to broadly follow that used by Arup during the 2013/14 surveys to allow for comparisons to be made between datasets, whilst also making slight amendments in order to address comments made by NRW. A suite of surveys was undertaken between September 2014 and April 2015 to encompass the winter, spring and autumn passage periods. This included the following.

- Scoping survey visit (September 2014).
- Transect surveys (September 2014 to April 2015).
- Vantage point surveys (September 2014 to April 2015). Vantage points focused on the same areas as in winter 2014, but the locations themselves were slightly different. In addition, survey hours were increased to six hours per month at each location. This means that peak counts for these surveys are much higher than the equivalent counts for the previous year's surveys.

10.3.92 Further details of the methodology and the findings of the wintering bird surveys are provided at Appendix 10.16.

10.3.93 NRW, in responding to the EIA Scoping Report (Appendix 5.1) noted and welcomed the scope and scale of works undertaken to date, but since there were land access constraints and the Arup winter bird survey did not cover the complete 2013/2014 winter, recommended that a further winter survey (October 2015 - March 2016 inclusive) across the full route corridor be undertaken to provide a more robust data set.

10.3.94 It was agreed with NRW that since the main areas of interest along the route corridor for winter birds were the Gwent Levels and rivers Usk and Ebbw, these would be the areas surveyed. A winter bird survey for 2015/2016 is therefore

being undertaken by Thomson Ecology to provide data for two full winters. This will be reported separately in due course.

10.3.95 The data from the previous two surveys are sufficient to establish the relative importance of the sections of the route corridor for wintering birds, and the value of the wintering bird assemblages for the purposes of this assessment.

Breeding Birds

10.3.96 The survey methods used to survey breeding birds by Arup in 2014 (Appendix 10.13) were derived from current best practice as described in Bird Census Techniques (Bibby *et al.*, 2000) and Bird Monitoring Methods (Gilbert *et al.*, 1998). The objectives of the survey were to gain an understanding of the breeding bird assemblage present within representative habitats within the study area, assessing the species present and relative abundance within different habitat types, and to highlight any key species or habitats of particular value that may influence the design of the Scheme.

10.3.97 Surveys consisted of walking eight transects designed to be representative of the predominant habitats suitable for breeding bird assemblages, and evenly distributed across the study area. The habitats surveyed included floodplain grazing marsh, farmland, wooded field boundaries, tracks and roads, river and estuary edges, reedbeds, wet scrub, lagoons, reens, and woodland. Full descriptions of the transects are available in Appendix 10.13. Each transect was surveyed on three occasions between April and June 2014.

10.3.98 All birds observed were mapped in accordance with the British Trust for Ornithology (BTO) standard activity recording codes. This included birds in flight, with the exception of large gulls that are abundant across the area.

Further Survey

10.3.99 As set out in Appendix 9.1 to the ES Scoping Report at Appendix 5.1 of this ES, at a Hyder/NRW meeting on 30th January 2015 it was explained that the breeding bird survey work carried out to date had entailed surveying a 'representative sample' of locations that were considered likely to be most suitable. Two main approaches were possible for further survey of breeding birds.

10.3.100 The first would be to carry out a similar methodology to the 2014 transect surveys, but in suitable areas of habitat within those parts of the site previously inaccessible (and which are within the footprint of the new section of motorway). A review of the updated Phase 1 mapping and aerial photographs would identify these locations.

10.3.101 An alternative approach would be to use a similar methodology to that used in the winter 2014/15 for wintering birds, whereby a comprehensive survey of the whole corridor was carried out using seven surveyors on the same day, with virtually all fields accessed and surveyed. This could be repeated for breeding birds, however, more surveyors would be likely to be needed (as linear features would need to be walked and nesting behaviour recorded), so ideally it would focus only on the key areas and features due to be directly affected.

10.3.102 NRW confirmed that they would be happy with either approach. Adopting the former approach would be more cost-effective, as it would use the 2014 survey

data and only focus on parts of the scheme not yet surveyed. Using the latter approach would be more consistent with the wintering bird work and perhaps more robust.

10.3.103 Having considered the report of the 2014 Breeding Bird Survey in the context of the above recommendations, RPS commissioned additional breeding bird surveys which were undertaken in May and June 2015, consisting of three visits to additional areas not covered during the previous year's surveys. The methodology used was as described in Bird Monitoring Methods (Gilbert *et al.,* 1998). Details of these areas are provided in the report at Appendix 10.28. The survey areas were as follows.

- Area BBS1 - an area of grassed fields with a small area of woodland to the west of Lighthouse Road which 'fills a gap' between previous transects.
- Area BBS2 - a complex area of scrub and wetland within the area of the old settlement lagoons associated with the Llanwern Steelworks.
- Area BBS3 - an area of fields with hedgerows and small woodland blocks to the east of Knollbury to provide information on typical breeding birds in the area at the east of the corridor.

10.3.104 A survey for ground nesting waders was carried out in May and June 2015 within 500 m of the proposed new section of motorway within the Gwent Levels (report at Appendix 10.28).

10.3.105 In addition, a targeted survey of trees and buildings for evidence of barn owl was carried out within 100 m of the footprint of the new section of motorway (report at Appendix 10.29). The survey method took in account methodology described in Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting (Shawyer, 2011).

10.3.106 The winter bird survey visit carried out by Hyder in April 2015 recorded some breeding birds, although the target species for these surveys was primarily the named wintering components of the Severn Estuary SPA/Ramsar site.

Aquatic Macrophytes

10.3.107 An aquatic macrophyte survey was carried out by Rachel Hacking Ecology in 2014 (Appendix 10.14). At each suitable site, the sampling methodology followed that of the Countryside Council for Wales Guidance Note 2: Flora Monitoring on the Gwent Levels Sites of Special Scientific Interest (CCW, 1996).

10.3.108 All plant species within the water were recorded, as well bank species. Each plant species was assessed for current rarity designations, such as Red Data Book, Nationally Scarce and/or species of principal importance in Wales (Section 42 of the NERC Act 2006).

Further Survey

10.3.109 A further survey of aquatic macrophytes was carried out by RPS in 2015. The survey method followed the Flora Monitoring on the Gwent Levels Sites of Special Scientific Interest (CCW, 1996) methodology. Macrophytes were recorded at a total of forty locations. Data was also obtained from a further four locations covered by the River Corridor Survey. Further details of the

methodology and the findings of the 2015 aquatic macrophyte survey are provided at Appendix 10.30.

Terrestrial and Aquatic Invertebrates

10.3.110 Rachel Hacking Ecology carried out a survey of terrestrial and aquatic invertebrates in 2014 (Appendix 10.15). At each suitable site, the following terrestrial invertebrate survey methods were used.

- Sweep-netting – A robust insect net was used to sweep the vegetation. For scrub this involved sweeping the net against high branches. Sweeping was also carried out along the ground to collect low-flying invertebrates.
- Hand-searching – This involved searching under fallen wood, in grass tussocks, sieving through the leaf-litter and searching beneath bark.
- Pootering – A pooter was used during all the above methodologies to catch smaller invertebrates that would otherwise have been missed.

10.3.111 The following methods were used for aquatic invertebrate survey.

- Direct observation - The water surface and emergent vegetation were searched for evidence of egg cocoons, reed beetles and similar genera and evidence of feeding or egg-laying, such as cut sections of floating leaves.
- Pond-netting - Areas of standing water (ditches, reens ponds) were netted for aquatic invertebrates using a heavy-duty pond net. All sections of the watercourse or waterbody were netted, including within submerged vegetation and within emergent vegetation, by sweeping the vegetation into the water. The water was netted until no new species were being caught.

Further Survey

10.3.112 As explained in Appendix 9.1 to the ES Scoping Report (Appendix 5.1 of this ES), at Hyder/NRW meeting on 30th January 2015, with regard to terrestrial invertebrates it was agreed that any surveys in 2015 could focus on areas not previously surveyed (owing to access restrictions) that are also considered (upon review of the Phase 1 and aerial photographs) to be potentially valuable, and which would be directly affected by the preferred alignment. NRW suggested that there were a number of brownfield sites that may not yet have been surveyed that would be potentially valuable for invertebrates. They also suggested that the shrill carder bee could also be the focus of targeted survey work. It was also suggested that in addition to this important species, the desk study information should be reviewed together with the Section 42 list (of species of principal importance for biodiversity) to determine whether any other species may require targeted surveys. It is possible, however, that these would already have been covered by the 2014 surveys. NRW suggested that moth trapping should be considered in certain areas, as moths could be an important group and traps are less likely to be stolen (as they are continuously monitored whilst in operation).

10.3.113 Having considered the need for further survey of terrestrial invertebrates in the context of the above recommendations, RPS commissioned further surveys of terrestrial invertebrates by David Gibbs (Consultant Entomologist) in 2015 (Appendix 10.31). The areas covered and methods used included the following.

- Land at the west of Newport Docks: Sweep-netting, vacuum sampling and targeted searching were carried out of potentially important features on three visits in mid-July, late-July and late August.
- Land in the southern part of the Tata Steel site: Sweep-net sampling (and vacuum sampling if suitable habitat present) on three days between July and early September.
- Bumblebee survey (in particular shrill carder bee *Bombus sylvarum* and brown-banded carder bee *B. humilis*): Three days of survey during July and August walking all fields where access permission obtained and which have some floral diversity. Other fields were assessed from roads and paths (i.e. arable and pasture).

10.3.114 Further details of the methodology and the findings of the 2015 invertebrate surveys surveys are provided at Appendix 10.31.

10.3.115 Moth trapping was proposed within the Tata Steel land but proved impractical for health and safety reasons.

10.3.116 The requirement for further survey of aquatic invertebrates was discussed with NRW and it was agreed that this was not necessary. For the purposes of this ES it is assumed that all reens and ditches within the various SSSI boundaries are capable of supporting the individually qualifying and invertebrate assemblage of each specific SSSI.

River Corridor Survey

10.3.117 RPS carried out a River Corridor Survey from August to October 2015. The survey area was based upon the alignment of the proposed new section of motorway, together with a 100 metre corridor on either side. Nineteen reens were surveyed.

10.3.118 The survey was conducted in accordance with the River Corridor Surveys: Conservation Technical Handbook 1 (NRA, 1992). The survey involved detailed mapping of the physical and vegetation features along approximately 300 metre sections of the watercourses along the length of the proposed new section of motorway.

10.3.119 Further details of the methodology and the findings of the 2015 River Corridor Survey are provided at Appendix 10.32.

Consultation

10.3.120 On 25 January 2013, Arup met with NRW to present the work undertaken previously in 2006 and 2009 and to review with NRW the changes in standards and design criteria since that time. A further meeting was held on 6th December 2013, the principal purpose of which was to discuss the ecological survey approach and programme in view of the future EIA process. On 7th February 2014 Arup wrote to NRW seeking confirmation that the proposed scope, methodology and timing of species specific ecological surveys was appropriate to inform any EIA and assessment under the Habitats Regulations.

10.3.121 On 2nd July 2014 a meeting was held at which Arup briefed Hyder (as advisers to the Welsh Government) and NRW on ecological survey methodologies and results.

10.3.122 A summary of the subsequent consultations relating to ecology and nature conservation is set out in Table 10.2 below. In particular, since commencement of the development of the route and environmental surveys in 2015, monthly liaison meetings have been held with NRW, with other meetings to discuss particular aspects of the Scheme as required.

10.3.123 Meetings were also held with the Newport City Council Ecologist and the Living Levels Project.

Assessment Criteria and Assignment of Significance

Receptor Value/Sensitivity

10.3.124 An assessment of the ecological effects of a proposed development should focus on 'valued ecological receptors' (VERs). These are species and habitats that are valued in some way, and could be affected by a proposed development; other valued ecological features may occur on or in the vicinity of the site of a proposed development but do not need to be considered because there is no potential for them to be affected significantly.

10.3.125 The evaluation of ecological resources for the purposes of this assessment has been based on the criteria set out in Table 10.3 below. The description of each level of value takes into account the definitions used in Chartered Institute of Ecology and Environmental Management (CIEEM) guidance (CIEEM, 2006), the guidance provided in the DMRB HA205/08 (Highways Agency, 2008a) and is consistent with Table 1 of Interim Advice Note 130/10 (Highways Agency, 2010). It should be noted that ecological receptors of medium value in the table below include assets of both regional and county importance whereas IAN 130/10 distinguishes between the two.

Table 10.2: Consultation Responses Relevant to this Chapter

Date	Consultee and Issue Raised	How/Where Addressed
Draft Plan consultation response (Welsh Government 2014)	Public response: Concern regarding impact on designated areas and on wildlife and habitats. Areas mentioned included ancient woodland.	Details of proposed mitigation measures and assessment of effects on habitats, including effects on ancient woodland are provided in this chapter.
	Natural Resources Wales: Noted that impact on designated sites, European eel and a number of bird species should be included in Habitat Regulations Assessment. Adverse effects on otter feature of River Usk could be avoided through ways of working during construction and retention of habitat.	An Assessment of Implications (of highways and/or roads projects) on European Sites (AIES) has been carried out and is reported separately.
	Chepstow Friends of the Earth, National Trust: Concern regarding harm to Gwent Levels and its biodiversity.	Details of proposed mitigation measures and assessment of effects on ecological interests associated with the Gwent Levels are provided in this chapter.
	Chepstow Friends of the Earth, Gwent Wildlife Trust, Buglife: Concern regarding fragmentation of Gwent Levels and effects on wildlife populations and effects arising from changes in water flow.	Details of proposed mitigation measures and assessment of effects on ecological interests associated with the Gwent Levels are provided in this chapter. Effects on hydrology within the Gwent Levels are considered in Chapter 16: Road Drainage and the Water Environment of this ES and the ecological implications are assessed in this chapter.
	Institute of Civil Engineers: Consider that it may be possible to include environmental measures to enhance SSSI areas and provide positive effects.	Details of proposed mitigation measures, including measures in relation to SSSIs, are provided in Section 10.5 of this chapter.
Environmental Liaison Group meeting (24 October 2014)	NRW/Newport City Council: It will be necessary to provide the contractor with an indication of what areas are available for compensation and mitigation.	Details of proposed mitigation measures are provided in Section 10.5 of this chapter.
	NRW: There will be a requirement to provide replacement reens as part of the Scheme, with no net decrease in water quality an absolute requirement.	Replacement reens are proposed. Details of effects on reen habitat are provided in this chapter. Assessment of the effects on hydrology and water quality is provided in Chapter 16 of this ES and the ecological implications are assessed in this chapter.

Date	Consultee and Issue Raised	How/Where Addressed
	Internal Drainage Board: Invasive species need to be considered during construction.	Invasive species identified in the ecology surveys are set out in section 10.4 of this chapter. The measures which would be implemented during construction to manage these species would be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) as referred to in Section 10.5 of this chapter.
30 January 2015	NRW and Hyder: Meeting between NRW and Hyder (Welsh Government's ecological advisor) to facilitate the ecology survey scoping for the 2015 season, so that the ecologist (once appointed) would have a valuable steer with regard to the level and extent of survey likely to be required to inform the ES.	Details of agreed scope of surveys taken into account in work undertaken during 2015/2016. Further consultation undertaken during the scoping process to further refine agreed scope of surveys.
Environmental Liaison Group meeting (11 May 2015)	NRW: Important to consider interactions between water quality and biodiversity.	Effects of water quality on biodiversity are considered in this chapter and this is informed by Chapter 16: Road Drainage and the Water Environment.
	NRW: The design should be undertaken in parallel with the EIA process and should be informed by it.	The design and EIA process have been undertaken in parallel, with the EIA process findings informing iterations of the design. Details of the approach to EIA are provided in Chapter 5 of this ES, while details of the main design alternatives considered are set out in Chapter 4.
	NRW: Locations of water treatment areas need careful consideration and discussion with NRW.	The locations of the water treatment areas have been discussed with NRW, and at their request, wherever practicable, they have been located to the north of the proposed new motorway.
NRW Response to EIA Scoping Report 18th September 2015	NRW: The ES should set out the scale of loss and damage to SSSIs as well as proposals for mitigation, compensation and enhancement.	The effects of the Scheme on SSSIs and the proposed mitigation are set out and assessed in this chapter.
	NRW: Main concerns for the features of the River Usk SAC and SSSI are: • Possible discharge of contaminated surface water into the River Usk during the construction and operation of the road; • Disturbance to migratory fish during construction, including from noise and vibration and potential obstacles to migration; and	The discharge of water to the River Usk during construction and operation of the road is addressed in Chapter 16: Road Drainage and the Water Environment and the ecological effects assessed in this chapter. Disturbance to otter and migratory fish is addressed in this chapter.

Date	Consultee and Issue Raised	How/Where Addressed
	• Disturbance to otter during construction, and impeding movement upstream and downstream.	
	NRW: Main concern for the Severn Estuary is potential impacts on the bird features of the Severn Estuary SAC, SPA, Ramsar site and SSSI from disturbance during construction and operation. An additional full winter (covering winter 2015/16) of overwintering bird data should be collected in order to be able to fully assess possible impacts of the Scheme proposals on the SPA/ Ramsar site bird features.	A winter bird survey covering the full winter 2015 to 2016 is being carried out and will be reported separately when complete. The data from the previous two surveys are sufficient to establish the relative importance of the sections of the Scheme corridor for wintering birds, and the value of the wintering bird assemblages for the purposes of this assessment. The potential impacts of the Scheme on the bird features of the Severn Estuary designated sites are addressed in this chapter, and also in the Statement to inform an Appropriate Assessment (SIAA).
	NRW: Likely significant effects cannot be ruled out for the River Usk SAC, the Severn Estuary SAC, SPA and Ramsar site, and the Wye Valley and Forest of Dean Bat Sites SAC. We therefore advise that the Welsh Government, as the competent authority, will need to carry out a test of likely significant effects under Regulation 61 of the Conservation of Habitats and Species Regulations 2010 (as amended).	In addition to consideration in this chapter of the ES, the assessment of effects on these European sites are assessed in the SIAA in accordance with the requirement of the Conservation of Habitats and Species Regulations 2010 (as amended).
	NRW: The ES should provide full details and assessments to demonstrate whether the proposal will have adverse effects on statutory protected sites. As part of this, the cumulative impacts of this proposal with other developments should be considered, as should the possible in-combination impacts with other proposals that are yet to start/ be completed.	The effects on statutory sites are assessed in this chapter. Cumulative/in-combination effects with other proposals are considered in Chapter 17 of this ES. For European Sites these effects are also assessed in the SIAA.
	NRW: recommend referring to the relevant Site Management Statement (SMS) for each affected SSSI as there is some variation in qualifying features for each Gwent Levels SSSI;	The qualifying features for all SSSIs have been taken from the relevant SMS and other information provided in the reasons for notification for the individual SSSIs.
	NRW: Bridge pier and drainage outfall within the boundary of the River Usk SAC within the River Usk SAC should be included within the overall assessment.	The effects of the east pylon of the bridge and drainage outfall to the River Usk are assessed in this chapter, and the effects of water discharge in Chapter 16: Road Drainage and the Water Environment.
	NRW: Gwent Wildlife Trust (GWT) and the Water Vole Steering Group should be consulted for 2015 survey records of water vole.	No specific request was made but the ecology desk study was updated in 2015 which provided additional water vole records.

Date	Consultee and Issue Raised	How/Where Addressed
	NRW: given the scale and location of the proposals 5 years post-construction monitoring should be extended to a 10 year period, and be linked to the need to take remedial action if monitoring results give cause for concern.	Proposals for ecological monitoring are set out in this chapter and would extend for 10 years following Scheme completion.
	NRW: Would welcome early discussions around potential mitigation and enhancement requirements, as well as discussion around dealing with in-combination effects of the proposals with other large scale schemes that have occurred within the Scheme footprint or in close proximity.	NRW have been consulted regarding the mitigation proposals and assessment of cumulative effects.
	NRW: In addition to the searches for breeding barn owls, we recommend that an assessment be made of any potential foraging and commuter routes (examining connectivity) for any breeding sites identified.	A potential barn owl nest site has been identified in the vicinity of the Scheme.
	NRW: Recommend that the list of potential effects of the Scheme during construction be expanded to consider storage and use of all materials required during construction, not just chemicals, as all have the potential to adversely affect the water quality, or water quantity within the Gwent levels system.	Storage and use of all construction materials which could have environmental effects will be addressed in the Construction Environmental Management Plan (CEMP) following the principles set out in the Pre-CEMP (Appendix 3.2).
	NRW: WTA should only be integrated into the SSSI water system if the water entering the SSSI system will be of appropriate quality and quantity, compatible with the features of interest, and also that contingency measures have been agreed if problems arise following implementation.	Quality of water discharges is addressed in Chapter 16: Road Drainage and the Water Environment.
	NRW: Noise and vibration impact assessment should include sensitive wildlife receptors; in particular potential impacts from vibration on migratory fish (including twaite and allis shad) on the Rivers Usk and Ebbw, and noise impacts during the construction phase on protected species and designated species features of any of the SSSIs.	The potential effects of noise and vibration on sensitive ecological receptors are assessed in this chapter, based on the noise predictions set out in Chapter 13: Noise and Vibration.
	NRW: Hedgerows do not form part of the designated interest of the Gwent Levels SSSIs. We are generally supportive of the removal of hedgerows where they are shading field ditches and reens as they limit the growth of the wetland vegetation which does form part of the special interest of these sites.	Noted.

Date	Consultee and Issue Raised	How/Where Addressed
	NRW: all parts of the Gwent levels drainage system are deemed to be capable of supporting the SSSI interest features at some stage in their management cycle, and therefore need to be considered as such as part of this EIA. All stages of succession create the mosaic of habitats needed for the various features of interest.	Noted and this is the approach taken in this assessment.
Newport City Council Response to EIA Scoping Report 13th October 2015	NCC: Documents referred to should include: • NCC Wildlife and Development SPG; and • Guidelines for the Selection of South East Wales Wildlife Sites.	These documents are referred to in this chapter.
	NCC: Newport Biodiversity Partnership should be consulted regarding the scope of ecology surveys.	The scope of the ecology surveys was discussed with NRW.
	NCC: It appears that a significant amount of the study area land is inaccessible and cannot be surveyed. How will this be addressed in the EIA?	This is apparently a misunderstanding of Figure 1 of Appendix 9.1 of the ES Scoping Report which shows the land to which there was no access during the Arup 2014 ecology surveys. In 2015, whilst there were still some areas which were not accessed, access was gained to the majority of the land to which Arup did not have access so that the surveys could be completed.
	NCC: Wish to see a comparison of coverage in the previous Arup surveys and the 2015 surveys.	The areas surveyed by Arup in 2014 and by RPS in 2015 are shown on the survey plans in the survey reports appended to this chapter. Since the respective areas varied from survey to survey it is not possible to produce a simple comparison plan.
	NCC: The proposed road would pass through a number of SINCs. Wish to see replacement of each qualifying SINC habitat/feature at a ratio of 1.5 to 1.	The target has been to replace BAP habitats lost at a ratio of 1.5:1, not just those habitats within SINCs.
	NCC: The assessment should indicate how the issue of fragmentation will be dealt with for all species.	The assessment in this chapter considers the effects of fragmentation on habitats and species
	NCC: Detailed comments on the scope of the ecology surveys.	Newport City Council made a number of detailed comments regarding ecological surveys. The majority related to the need for additional surveys to be carried out in 2015. The reports of the 2015 surveys are at Appendices 10.19 to 10.33 and Confidential Appendix 10.38. The results are summarised in the description of the baseline environment in Section 10.4 of this chapter.

Table 10.3: Value of Ecological Receptors

Value	Description
Very High	International Importance. Sites of European or greater than UK or Welsh significance (SAC, SPA, Ramsar Site). Resident, or regularly occurring, populations of species which may be considered at an International or European level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale.
High	Sites of UK or National (Welsh) Importance (SSSI & National Nature Reserves (NNR)). Priority habitats in UK BAP and NERC Act (2006). Ancient woodland. Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale.
Medium	Sites of Regional (South East Wales) or County Importance (e.g. Sites of Nature Conservation Importance – SINCs). Priority habitats in Regional BAP. Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key/priority species listed within Local BAPs or the Trunk Road Estate BAP 2004-2014 (Welsh Assembly Government, 2004) where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle.
Low	District Importance. Designated sites including Local Nature Reserves (LNRs) designated in the local context. Areas of habitat; or populations/communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.
Negligible	Parish or very local importance only.

10.3.126 In valuing habitats, due account has been taken of the guidance of CIEEM (2006). In particular with respect to BAP habitats for which Habitat Action Plans (HAPs) have been prepared, the guidance states (paras 3.26 and 3.27) that:

'The purpose of HAPs is to guide conservation action for the habitats concerned. That a HAP has been prepared should simply reflect the fact that the habitat concerned is in a sub-optimal state (and hence that action is required). It does not imply - and was never intended to imply - any specific level of value for the habitat. The value of any area of habitat covered by a HAP should therefore be determined on the basis of its intrinsic characteristics using the same approach as with other habitats.

The only exception to this should be where a HAP states that all areas of a particular habitat should be protected, as is often the case for priority habitats. In such cases, ecologists may decide that it is appropriate to treat applicable areas as being important at the level of the BAP in question. For example, if a county BAP identifies an action to protect all areas of a particular habitat (where there is no similar recommendation in the UK, national or regional BAP), each area could be considered to be of county importance. It should be noted that some BAPs do not qualify their recommendations about specific habitats, for example in relation to the size of habitat areas. Some interpretation may be needed to avoid obvious anomalies, for example, it may be inappropriate to classify a small patch of reedbed within a gravel pit as of county importance just because a county BAP action proposes the protection of all reedbeds.'

10.3.127 Similarly in valuing species included in BAPs, the guidance states (para 3.35) that:

'There are numerous species whose populations are in decline throughout the UK. Many of those for which the decline is most serious, 'priority species' are the subject of Species Action Plans (SAPs) in the UK BAP. Other species are the subject of action plans in sub-national BAPs. The purpose of SAPs is to guide conservation action for the species concerned. As with habitats, the existence of a SAP should reflect the fact that the population of the species is in a sub-optimal state. It does not imply - and was never intended to imply - any specific level of value for the species. The value of the population of a species covered by a SAP should therefore be determined using the same approach as with other species.'

10.3.128 Thus in assigning a value to a site, habitat or species population or assemblage, its distribution and status (including a consideration of trends based on available historical records) are considered. Rarity is considered because of its relationship with threat and vulnerability, and the need to conserve representative areas of habitats and genetic diversity of species populations, although rarity in itself is not necessarily an indicator of value. A species that is rare and declining is assigned a higher value than one that is rare but known to be stable.

10.3.129 The valuation of sites also takes full account of existing value systems such as SSSIs and Local Wildlife Site designations. Judgement is required for the valuation of sites of less than county importance.

10.3.130 In accordance with the CIEEM (2006) guidelines the value of habitats takes into account published selection criteria. These include size (extent), diversity, naturalness, rarity, fragility, typicalness, recorded history, position in an ecological or geographical unit, current condition and potential importance.

10.3.131 Criteria for the valuation of habitats and plant communities include Annex III of the Habitats Directive, guidelines for the selection of biological SSSIs and criteria used by local planning authorities and the Wildlife Trusts for the selection of local sites. Legal protection status is also a consideration for habitats where these are features of statutory designated sites.

10.3.132 Species populations are valued on the basis of their size, recognised status (such as recognised through published lists of species of conservation concern and designation of BAP status) and legal protection status. For example, bird populations exceeding 1% of published information on biogeographic populations are considered to be of international importance, those exceeding 1% of

published data for national populations are considered to be of national importance, etc.

10.3.133 In assigning values to species populations, it is important to take into account the status of the species in terms of any legal protection to which it is subject. However, it is also important to consider other factors such as its distribution, rarity, population trends, and the size of the population which would be affected. Thus, for example, whilst the great crested newt is protected under the Habitats Directive, and therefore conservation of the species is of significance at the international level, this does not mean that every population of great crested newt is internationally important and thus of very high value. It is important to consider the particular population in its context. Thus in assigning values to species the geographic scale at which they are important has been considered. The assessments of value rely on the professional opinion and judgement of experienced ecologists.

10.3.134 Due regard has been paid to the legal protection afforded to such species in the development of mitigation measures to be implemented during construction and operation of the Scheme. For European protected species there is a requirement that a scheme should not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range, i.e. to maintain favourable conservation status, a scheme should not affect the long term availability of sufficient habitat required by the population, the long term viability of the population, or the long term natural range of the species.

10.3.135 Assessing feature values requires consideration of both existing and future predicted baseline conditions and, therefore, the description and valuation of ecological features takes account of any likely changes, including for example, trends in the population size or distribution of species, likely changes to the extent of habitats and the effects of other proposed developments or land use changes.

Magnitude of Impact

10.3.136 In addition to considering the value of the habitats and species which would be affected on a local, regional and national scale, the likely impacts of the Scheme have been assessed in terms of the:

- type of impact – whether the Scheme would result in a positive or negative impact on the identified valued ecological receptors;
- magnitude of the impact, (size or intensity measured in relevant terms e.g. numbers of individuals lost or gained, area of habitat lost or created);
- extent or spatial scope of the impact;
- likely duration of the impact;
- reversibility of the impact – whether the effect is naturally reversible or reversible through mitigation action; and
- timing and frequency of the impact, in relation to ecological changes.

10.3.137 Table 10.4 below indicates how the magnitude of impacts has been described within this assessment, taking into account guidance provided in the DMRB HA 205/08 (Highways Agency, 2008a).

Table 10.4: Magnitude of Impacts

Magnitude	Criteria
Major	Adverse - Loss of resource and/or quality and integrity of resource: severe damage to key characteristics, features or elements. Detrimental effect on conservation status. Beneficial - Large scale or major improvement of resource quality: extensive restoration or enhancement: major improvement of attribute quality. Notable improvement in conservation status.
Moderate	Adverse – Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements. Some detriment to conservation status. Beneficial – Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality. Some improvement to conservation status.
Minor	Adverse – Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. Beneficial – Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact or attribute or a reduced risk of negative impact occurring.
Negligible	Adverse – Very minor loss or detrimental alteration to one or more characteristics, features or elements. Beneficial – Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

10.3.138 Conservation status is described by the Chartered Institute of Ecology and Environmental Management (2006) as follows:

Habitats – '… the sum of the influences acting on the habitats and its typical species, that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area';

Species – '… the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area'.

10.3.139 The assessment of whether the favourable conservation status of a Valued Ecological Receptor (VER) is likely to be compromised has been made using professional judgement based on an analysis of the predicted impact of the Scheme (including consideration of the specific parameters outlined above). For designated sites that are affected by the Scheme, the focus has been on the impacts on the integrity of the site, i.e. the ability of the site to continue to maintain conditions which would allow the key species and habitats for which it was designated to flourish. In assessing impacts on these sites, the focus has been on impacts on the key species and those habitats and features of value to them.

10.3.140 In assessing the magnitude of impacts consideration has been given to the fragility/stability of the habitats and the sensitivity of the species potentially affected by the Scheme. Fragile habitats are those which are readily damaged by human activity. Fragility is to some degree the inverse of stability, which can be defined as the ability of an ecosystem to maintain some form of equilibrium in

the presence of perturbations. Fragility and stability can be expressed in terms of the degree of change in species abundance and composition following disturbance. Sensitive species are those that are highly susceptible to disturbance. This may be direct disturbance as result of human activity, noise etc, or disturbance as a result of habitat change where a species is particularly associated with a specific habitat and would be lost for the area if that habitat is removed.

10.3.141 As noted in CIEEM (2006) (para 4.42):

'Many ecosystems have a certain 'freeboard' in terms of biophysical change that can be absorbed before the fundamental ability of the site or ecosystem to support characteristic habitats or species populations is compromised. Clearly there will sometimes be an element of doubt as to whether the change is sufficient to cause such changes to condition……. This should be reflected in confidence levels attached to the prediction. Mitigation measures may then be proposed to increase the level of confidence in that prediction, even when a negative effect on integrity is not predicted.'

10.3.142 Where likely adverse impacts have been identified, mitigation methods have been incorporated into the Scheme where practicable.

Significance of Effect

10.3.143 The significance and scale of the effects on the identified VERs has been assessed in terms of the value and sensitivity of the sites, habitats and species that would be affected and the predicted magnitude of impact. The nature of the effects has been classified as adverse, beneficial or neutral.

10.3.144 The guidance of CIEEM (2006) states (paras 4.28-4.28) that:

'Legislation and policy guidance often require significant negative or positive impacts to be distinguished from others, although there is little guidance on how this distinction should be made. In this guidance an ecologically significant impact is defined as an impact (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area…..

The value of any feature that will be significantly affected is then used to identify the geographical scale at which the impact is significant. This value relates directly to the consequences, in terms of legislation, policy and/or development control at the appropriate level. So, a significant negative impact on a feature important at one level would be likely to trigger related planning policies and, if permissible at all, generate the need for development control mechanisms, such as planning conditions or legal obligations, as described in those policies.'

10.3.145 Thus the guidance results in assessment of significance as being Not Significant; Significant at the Local Level; Significant at the District Level; etc.

10.3.146 Following the general approach described in Chapter 5 of this ES and taking into account the guidance provided in the DMRB HA 205/08 (Highways Agency *et al.,* 2008) and Table 3 of IAN 130/10 (Highways Agency, 2010), levels of significance have been defined as follows.

- Very large: Only adverse effects are normally assigned this level of significance and they should be considered to represent key factors in the decision-making process. Effects are likely to be significant on one or more receptors at a national, UK, European or international scale.
- Large: Effects are considered to be very important considerations and are likely to be material in the decision-making process. Such effects are likely to be significant for one or more receptors at a regional scale.
- Moderate: Effects may be important, but are not likely to be key decision-making factors. Such effects are likely to be significant for one or more receptors at a County or Unitary Authority Area scale.
- Slight: Effects are not likely to be important in the decision-making process, but are to be considered in enhancing the design of the project. Such effects are likely to be significant for one or more receptors at a local scale.

10.3.147 Effects that are of such low significance that they are not considered material are assessed as 'neutral'. Effects of 'moderate' or greater significance are considered to be significant in terms of the EIA Regulations.

10.3.148 Beneficial effects, where present, are described within the text and should also be considered within the decision-making process.

10.3.149 The assessment has been undertaken on the basis of the guidance referred to above. As explained in the Methodology chapter of this ES (Chapter 5), DMRB guidance on the assessment of significance of effects is based on a matrix approach and Table 10.5 below provides a guide to assessment based on this approach.

Table 10.5: Significance of Effects

Value	Magnitude of Impact				
	No Change	**Negligible**	**Minor**	**Moderate**	**Major**
Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight
Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or Moderate
Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or Large
High	Neutral	Slight	Slight or moderate	Moderate or Large	Large or Very large
Very High	Neutral	Slight	Moderate or large	Large or Very large	Very large

Source: Based on Table 2.4 of DMRB Volume 11, Section 2, Part 5 (Highways Agency, 2008a)

10.3.150 Taking the above into account, habitats, sites or species of less than district level importance are not considered to be VERs for the purpose of this assessment since even impacts on such features whose magnitude is major only give rise to effects whose significance is slight (see Table 10.5) and not significant in EIA terms.

Timescale of Effects

10.3.151 For the purposes of the assessment the following timeframes are referred to in relation to the duration of effects and/or the time required for mitigation measures to become effective:

- Short-term: one to three years.
- Medium-term: four to nine years.
- Long-term: greater than nine years.

Limitations of the Assessment

Ecology Desk Study

10.3.152 The distribution of species records is determined by the level of survey effort undertaken in a given area and takes into account incidental findings in areas where people are likely to come into contact with a particular species, such as road casualties and bat roosts in properties.

10.3.153 Whilst the records show where a species has been recorded they do not show where a species is absent. A lack of records in a particular area may be due to no surveys having been undertaken and no incidental sightings being made.

10.3.154 The findings of the desk study have not been relied upon alone to determine species presence or absence but have been used to help inform where further, more detailed surveys are required for a particular species.

2014 Arup Surveys

10.3.155 The reports of surveys undertaken by Arup in 2014 identify the limitations of those surveys. Land access constrained most of the 2014 surveys and the additional surveys carried out by RPS in 2015 aimed to provide further information for the areas not previously surveyed to inform the EIA. RPS has undertaken or commissioned additional surveys in 2015 specifically focussing on areas where Arup did not have access. Hyder also undertook an additional winter bird survey over the winter of 2014/2015.

10.3.156 In addition to access, other specific limitations referred to in the 2014 reports are summarised in the following paragraphs.

10.3.157 NVC Survey - Due to difficulties in arranging access, some sites had to be visited in wet weather and this is likely to have reduced the number of species recorded. However, the surveys that were carried out during the rain would still have identified all of the main species and plant communities.

10.3.158 Hedgerow Survey - Due to the scale of the survey, some of the hedgerows were surveyed later in the year when the flora could not be as easily identified. Therefore woodland ground flora (for example) may not have been recorded. A detailed record could not be made of some hedges due to these hedges having been flailed limiting species identification. In one instance a hedgerow could not be accessed due to dense scrub.

10.3.159 Great Crested Newt Survey- In some instances there were limitations to the surveys with respect to the ability to use certain survey methods (e.g. dense vegetation limiting ability to use torch survey method), which limited the number of visits possible to each waterbody. Rain showers and resultant changes in water levels also affected the ability to use certain survey methods, as did health and safety considerations where reens were steep-sided.

10.3.160 Bat Activity Survey - There is the potential that some bat calls may have been overlooked principally due to the fact that the automatic species identification

systems cannot identify multiple species within the same sound clip. However, with the exception of files identified as common or soprano pipistrelle by the software, all other files were checked and all species recorded within those files included within the results set out in the report. Some monitoring visits were missed due to equipment failures or wet weather resulting in no bats being recorded.

10.3.161 Otter and Water Vole Survey - The main limitations of the survey were as follows.

- Dense vegetation including vegetation growing in and adjacent to the waterbody.
- Security fencing stopping access to waterbody.
- Health and safety concerns with regard to situations such as dangerous animals (e.g. cattle, horses, dogs).
- Poaching of bankside occluding field signs.
- Steep banks and deep water (although where possible a kayak was used to overcome this constraint).
- Heavy rain resulting in survey being cancelled.
- Rain showers wetting field signs.

10.3.162 Dormouse Survey - At the site to the south of Pen-y-lan Farm a number of the nest tubes were damaged by cattle. These were replaced once but further damage occurred. Therefore, to minimise the risk to dormice the decision was made to remove the affected tubes from the survey. This is not thought to have adversely affected the conclusions of the survey due to the number of tubes placed within the wider connected habitat and the historic presence of dormice within the area. As the Gwent Levels area was only surveyed for the latter part of the survey period results from this area are limited; however, this area was not considered likely to support dormice and this area was only included in the 2014 survey programme to gain additional evidence to support the understanding that dormice are absent from the Levels.

10.3.163 Badger Survey - The timetable for the badger survey work was dictated by project programme, which resulted in survey work being carried out between April and November. Whilst badgers are active at this time and fresh field signs can be found, locating setts can be constrained by vegetation growth. Whilst camera traps were used to reduce this limitation it remains a possibility that setts were not visible in dense cover.

10.3.164 Hedgehog Survey – There were some problems as a result of vandalism, bait being removed by domestic cats and adverse weather.

10.3.165 Winter Bird Survey - The winter bird survey was carried out at an appropriate time of the year but did not commence until January 2014 and so the first half of the winter was not covered.

10.3.166 Aquatic Macrophytes - Some reens were difficult to access for the whole 20 metre stretch due to dense vegetation and/or steep banks.

10.3.167 Terrestrial and Aquatic Invertebrates - Static collection techniques (i.e. pitfall traps, yellow bowl traps or malaise traps) were not used on all of the sites in 2014. This was for a number of reasons. Either the site was accessed by cattle

or by the general public, or it was not possible to set traps within the ground or within strong vegetation. During some site visits, the weather conditions were not optimum for terrestrial invertebrate survey (e.g. rain or strong winds). Therefore, on some of the multiple visits, invertebrates may have been missed.

2014-2015 Hyder Wintering Bird Survey

10.3.168 This survey was carried out to provide a full winter's data in view of the late start of the previous Arup survey. Three main limitations were identified during the survey period (listed below). However, it is not envisaged that these would have any significant influence on the outcome of the survey results.

- It was not possible to survey 100% of the survey area, due to access restrictions. However, areas omitted from the survey primarily included areas of residential/ urban land which were considered to be of low potential value to waterfowl.
- Whilst there will always be some level of under-recording on transect surveys of this scale (particularly in relation to the more cryptic species), the 'field count' approach that has been adopted could accentuate this. Particular species that won't always have been visible or recorded include: snipe and jack snipe (which are generally only recorded by 'flushing' birds); ducks and water rail using the reens and ditches; and passerines using fields and hedgerows.
- Given the amount of walking required to complete the hourly Vantage Point counts, it is possible that the flight movements recorded may have been underestimated. This was particularly relevant on the River Usk where the river is wider and a lot of time was spent walking over the saltmarsh habitat, which meant that the ability to record flight movements was limited.

2015 RPS Surveys

10.3.169 The 2015 surveys were subject to some limitations. This section summarises the limitations and indicates where these may have affected the survey findings.

10.3.170 Extended Phase 1 Habitat Survey - There were some limitations on access to land. These were minimal, with the majority of Phase 1 habitat mapping completed without restriction. The landfill site to the west of Newport Docks was not surveyed. The data collected through the Arup and RPS surveys are sufficient for the purposes of the EIA.

10.3.171 Waxcap Survey - When the NVC Survey of the Pound Hill site was carried out in 2014, the grassland was grazed by horses and a high proportion of it appeared to be very favourable for fungi. However, at the time of the waxcap survey in Autumn 2015 the field did not appear to have been grazed during 2015 and the short grassland most suitable for waxcaps was limited to a few patches maintained by rabbit grazing. If the grassland had remained grazed by horses as it had been in 2014, then several more species might have been recorded. More survey visits would have resulted in additional fungi observations but would have been unlikely to have significantly altered the overall assessment.

10.3.172 Bat Roost Survey - Due to health and safety considerations and owner permissions, full access wasn't possible into some of the buildings identified as having bat roost potential. This was mitigated by further dusk emergence surveys. However, further dusk emergence surveys on the buildings at Fair

Orchard Farm could not be undertaken. Some trees could not be climbed for health and safety reasons, or due to restricted access.

10.3.173 Following the completion of the survey period, it was found that a microphone in one of the detectors had detached internally. The result of this error is that some locations have only five or ten nights worth of data, rather than 15 nights. Therefore, averages for each affected location have been calculated using the survey visits for which data were obtained.

10.3.174 As in 2014, *Myotis* species have been grouped together due to difficulties in identification from their similar echolocation recordings. In addition, in some cases noctule, serotine and Leisler's bats have been grouped together, due to the overlap in call parameters that can make it difficult to distinguish between the species during data analysis.

10.3.175 The data collected through the Arup and RPS surveys are sufficient for the purposes of the EIA but further bat roost surveys will be undertaken to further inform the detail of any European Protected Species Licence Method Statement.

10.3.176 Otter and Water Vole Survey - The main limitations of the survey were similar to those listed by Arup for the 2014 survey referred to above. NRW has records of a known otter holt within the Docks Way Landfill. However, there was no access to this area for the survey. Management of the bankside vegetation hindered to survey in some situations. Poaching from livestock, strimming of the vegetation and bank re-profiling potentially removed or obscured field signs. Due to the nature of management of the reens within the Gwent Levels, water levels fluctuate. Therefore, not all of the waterbodies hold water for the entire year. In some instances the field ditches did not hold water at the time of survey, but this does not mean that at another time of year that waterbody would not be suitable. The data collected through the Arup and RPS surveys are sufficient for the purposes of the EIA but as both otter and water vole are mobile species, further surveys would be carried out in advance of construction. In the case of otter this would further inform the detail of any European Protected Species Licence Method Statement.

10.3.177 Dormouse Survey – Access for nest tube installation and checking of tubes previously installed by Arup was available from mid-May 2015. Access arrangements and subsequent inductions onto Tata Steel land were not completed until August 2015. The additional tubes were installed at Tata Steel following the discovery of a dormouse nest in September 2015.

10.3.178 At the Knollbury Woodland and fields, a number of the nest tubes were damaged by cattle part way through the survey. The tubes were not replaced to minimise the risk to dormice if any present. This is not thought to have adversely affected the conclusions of the survey due to the number of tubes placed within the wider connected habitat.

10.3.179 A few other nest tubes were damaged during the survey in some areas by horses or other factors, but again it is thought that this would not adversely affected the conclusions due to the number of tubes within that survey area and the presence of dormice already confirmed at that location.

10.3.180 In some of the proposed search areas there was little or no hazel so not many nuts were collected during the nut search. Also access into some of the proposed search areas was not possible due to the road layout and barriers. The

data collected through the Arup and RPS surveys are sufficient for the purposes of the EIA but further dormouse survey will be undertaken in 2016 to provide additional information on the population to inform the detail of any European Protected Species Licence Method Statement.

10.3.181 Breeding Bird and Breeding Wader Surveys - Due to access restrictions, both the breeding bird surveys and breeding wader surveys were mostly restricted to transect routes along public roads and footpaths. The standard breeding bird survey methodology could not therefore be followed as this method requires two parallel transects spaced 500 metre apart to be walked in each 1 km square surveyed.

10.3.182 The surveys were carried out during May and June 2015. No surveys were carried out during April as access to land was not available. Breeding birds vary in detectability over short time periods, so some species may have finished singing by May. Resident species especially sing early in the spring and so may have been under-recorded. Warblers also have brief song periods and then become quieter after mating. Some of these species may also be under-recorded. The data collected through the desk study, and the Arup and RPS surveys are sufficient to establish the breeding bird interest of the site for the purposes of the EIA.

10.3.183 Barn Owl – One of the trees identified as a potential barn owl nest site could not be climbed and fully assessed as it was covered by dense ivy. Therefore it was considered to be a likely barn owl nest. The data collected through the Arup and RPS surveys are sufficient for the purposes of the EIA. Further survey will be undertaken pre-construction to confirm the status of any potential nest sites.

10.3.184 Terrestrial invertebrates – The late start (July) of the surveys of land within Newport Docks and Tata Steel due to delays in obtaining access meant that potentially important invertebrates with flight periods between April and June will have been missed. Weather conditions were unreliable and somewhat variable and to some degree affected these and the bee survey of the Gwent Levels. The data collected are sufficient to establish the value of the sites surveyed for invertebrates for the purposes of the EIA.

10.3.185 River Corridor Survey - There were some limitations to the survey as follows.

- Dense vegetation, including vegetation growing in and adjacent to the waterbody, restricting access to view into channel.
- Security fencing stopping safe access to parts of the waterbody.
- No access permission granted at the time of the survey.
- Health and safety concerns with regard to dangerous animals (e.g. cattle, horses, dogs).

10.3.186 Along some reens, vegetation management had resulted in the loss of plant species through mowing and strimming. This is likely to have resulted in a reduction in the number of plant species being recorded. The data collected provide sufficient information on the watercourses for the purposes of the EIA.

10.4 Baseline Environment

10.4.1 This section provides a summary of the key findings of the desk study and surveys undertaken to provide the baseline data for the Scheme. Further details of the findings of the desk study and surveys are provided in the appendices to this chapter.

Statutory Designated Sites

10.4.2 Information on statutory designated sites, including Special Areas of Conservation (SACs), Special Protection Areas (SPAs), SSSIs and National Nature Reserves (NNRs) was obtained though the desk studies (Appendices 10.2 and 10.17) and is summarised in this section. International statutory designated sites are shown on Figure 10.1 and nationally designated sites on Figure 10.2.

River Usk SAC and River Usk (Lower Usk) SSSI

10.4.3 The River Usk/Afon Wysg SAC extends from the Black Mountains in the west of the Brecon Beacons National Park and flows east and then south to enter the Severn Estuary at Newport. The primary reason for the designation of the SAC is the presence of a range of fish species (including sea lamprey, brook lamprey, river lamprey, twaite shad, Atlantic salmon and bullhead) and otter. The citation for the SAC also notes the presence of watercourse habitat (watercourses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation) and allis shad as qualifying features, although not the primary reason for designation.

10.4.4 The River Usk is also designated at the national level as a SSSI. The relevant part of the river through Newport forms part of the River Usk (Lower Usk) SSSI, which extends from Abergavenny to the confluence with the River Ebbw at Newport where it enters the Severn Estuary. The SSSI citation notes that the river is one of the largest in Wales and that the Lower Usk represents an example of a large lowland river not subject to significant modification. Upstream of Abergavenny the River Usk (Upper Usk) SSSI extends along the course of the river to Glasfynydd Forest on the northern edge of Fforest Fawr in Powys.

10.4.5 The special features of the SSSI are as follows.

- Running water supporting *Ranunculion* vegetation.
- Otter.
- Fish species.
- A group of rare craneflies.

10.4.6 The SSSI citation indicates that in addition to the fish and otter populations, the invertebrate fauna is characteristic of a large lowland river, with craneflies of particular interest. Scarce higher plant communities at the river's tidal reaches are also of special interest. Although not a special feature of the site, there is a good range of breeding birds associated with the riverine habitats. The SSSI designation includes some areas of adjacent habitat, such as woodland, marshy grassland, stands of tall herb, swamp and fen vegetation, saltmarsh and coastal grassland.

Severn Estuary SAC, SPA, Ramsar Site and SSSI

10.4.7 The Severn Estuary/Môr Mafren is designated as a European Marine Site, incorporating SAC, SPA and Ramsar site designations. The European Marine Site includes the following features.

- Estuary.
- Subtidal sandbanks.
- Intertidal mud and sand.
- Atlantic salt meadow/saltmarshes.
- Reefs.
- Migratory fish (river and sea lamprey, twaite shad, salmon, eel, sea trout and allis shad) and assemblage of fish species.
- Internationally important populations of migratory and wintering bird species.
- Internationally important populations of waterfowl.
- Rocky shores.
- Freshwater grazing marsh/neutral grassland.

10.4.8 The River Severn is also designated at the national level as a SSSI. The citation sets out the estuarine fauna, which includes invertebrate populations of considerable interest in addition to the internationally important populations of wintering waterfowl and migratory fish. In addition, the estuary fringes include areas of saltmarsh supporting a range of saltmarsh types.

Wye Valley and Forest of Dean Bat Sites SAC, Mwyngloddfa Mynydd-Bach SSSI and Wye Valley Lesser Horseshoe Bat SSSI

10.4.9 The Wye Valley and Forest of Dean Bat Sites/Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC is designated for lesser horseshoe and greater horseshoe bats.

10.4.10 The site 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.

10.4.11 The SAC includes four SSSIs, of which two are within the study area: Mwyngloddfa Mynydd-Bach SSSI and Wye Valley Lesser Horseshoe Bat SSSI.

10.4.12 Mwyngloddfa Mynydd-Bach SSSI provides habitat for the lesser horseshoe bat, including disused mines providing hibernation habitat. Wye Valley Lesser Horseshoe Bat SSSI is a composite bat site, including summer nursery roosts for lesser horseshoe bat. Collectively, these form the most important population centre for the species in the UK.

Gwent Levels SSSIs

10.4.13 Much of the Gwent Levels is designated as SSSIs. The SSSIs within the study area are:

- Gwent Levels – Rumney and Peterstone SSSI;
- Gwent Levels – St Brides SSSI;
- Gwent Levels – Nash and Goldcliff SSSI;
- Gwent Levels – Whitson SSSI;
- Gwent Levels - Redwick and Llandevenny SSSI; and
- Gwent Levels – Magor and Undy SSSI.

10.4.14 The special features of these SSSIs are reen and ditch habitat; insects and other invertebrates (aquatic); and shrill carder bee. The reens and ditches within the Gwent Levels support a wide range of aquatic plants, including many rare or scarce species, which in turn support a wide variety of other wildlife. There is a diverse community of insects and other invertebrates (for example, water beetles) inhabiting the reens and ditches. The assemblage of water beetles found across the Gwent Levels is unique in Wales and includes the great silver beetle, which is found nowhere else in Wales and is restricted to only a few other sites in southern England.

10.4.15 The unmown ditch banks and rough grassland areas provide habitat for the shrill carder bee, as they contain the flowers preferred by the bee for sources of nectar and pollen, such as red clover, creeping thistle and black knapweed.

10.4.16 The reens and ditches also provide habitat for protected species including otter, water vole, grass snake and amphibians.

10.4.17 In addition to these features, which are common to all of the Gwent Levels SSSIs, there are specific interests associated with the individual SSSIs.

10.4.18 The Rumney and Peterstone SSSI supports a number of important plant species including the nationally rare brackish water-crowfoot *Ranunculus baudotii* and several regional rarities, including the pondweeds *Potamogeton obtusifolius* and *Potamogeton berchtoldii*. The northern section of this SSSI is a stronghold on the Gwent Levels for the flowering rush *Butomus umbellatus*. It also supports a rich and important invertebrate fauna with a number of nationally notable species largely confined to this SSSI including the marsh flies *Pherbellia brunnipes* and *Lamprochromus elegans*, the water beetle *Plateumaris braccata* and the variable damselfly *Coenagrion pulchellum*.

10.4.19 The reens in the St Brides SSSI support a number of interesting plant species most notably thread-leaved water crowfoot *Ranunculus trichophyllus* and small pondweed *Potamogeton berchtoldii*. Reen bank and green lane habitats in this area are also important for relict meadow plant species, such as the regionally notable grass vetchling *Lathyrus nissolia* and common meadow-rue *Thalictrum flavum*. The St Brides SSSI also supports rich invertebrate communities with a number of nationally notable and notable marshland species, e.g. the true fly *Chrysogaster macquarti* and the beetle *Hydaticus transversalis*. It is the only area on the Gwent Levels where the rare fly *Stenomicra cogani* has been recorded.

10.4.20 The Nash and Goldcliff SSSI of particular botanical interest as it is the only area in Wales for the least duckweed *Wolffia arrhiza*. There is also an interesting community where two species of hornwort *Ceratophyllum submersum* and *C. demersum* grow together. The invertebrate interest is also high, as rare and notable species such as *Odontomyia ornata*, *Oplodontha viridula* and *Hydaticus transversalis* are present.

10.4.21 The Whitson SSSI is of particular importance for its large number of nationally rare and notable invertebrate species. A total of 65 of these rare invertebrates have been recorded in this area, including *Anthomyza bifasciata*, *Coptophlebia volucris* and *Hydrophilus piceus*. This area is also important for its botanical interest as it contains the nationally rare hairlike pondweed *Potamogeton trichoides* and is the only location in Gwent for the tussock sedge *Carex elata*. Arrowhead *Sagittaria sagittifolia* also grows in abundance in several main reens in this area.

10.4.22 The Redwick and Llandevenny SSSI supports rich assemblages of invertebrate species, including *Chalcis sispes* a parasite of the *Stratiomys* fly larvae, the beetle *Scirtes orbicularis* and the drone fly *Pharhelophilus consimilis*. The SSSI also contains a number of nationally rare plant species, including the rare *Myriophyllum verticillatum* located in peaty ditches in the northern part of the site and the brackish water crowfoot *Ranunculus baudotii* associated with the ditches bordering the sea wall.

10.4.23 The Magor and Undy SSSI is the most easterly of the Gwent Levels SSSIs supporting a total of 43 nationally rare and notable invertebrate species such as the soldier fly *Stratiomys furcata*, the snail killing fly *Pherbellia brunnipes* and the water beetle *Haliplus mucronatus*. This area also supports a number of rare and notable aquatic plant species, including the pondweed *Potamogeton trichoides* and *P. berchtoldii* and the narrow-leaved water plantain *Alisma lanceolatum*. The sea wall back ditch contains brackish water fauna and flora such as the water beetle *Agabus conspersus* and the nationally rare brackish water crowfoot *Ranunculus baudotii*.

Newport Wetlands SSSI, National Nature Reserve (NNR) and RSPB Reserve

10.4.24 Newport Wetlands is an SSSI, NNR and RSPB Reserve and is of importance for its bird species. The special features are as follows.

- Reens and ditches.
- Reedbeds.
- Higher plants.
- Over-wintering birds.
- Breeding birds.
- Insects and other invertebrates (aquatic).

10.4.25 The site supports nationally important numbers of shoveler and black tailed godwit, together with other over wintering species. During summer, the wet grassland, saline lagoons and reedbeds support a variety of breeding birds, including populations of avocet, redshank, lapwing, water rail, Cetti's warbler and bearded tit. The habitats also support a diverse assemblage of aquatic invertebrates and aquatic plants.

Magor Marsh SSSI and Gwent Wildlife Trust Reserve

10.4.26 Magor Marsh SSSI is the largest remnant of the formerly extensive fenlands near the Gwent coast. The special features of the site are as follows.

- Marshy grassland.
- Neutral grassland.
- Swamp.
- Standing water.
- Wetland invertebrate assemblage.

10.4.27 The site supports a variety of common reed (*Phragmites australis*), sedge (*Carex* spp.) and submerged and emergent aquatic plants. Areas of wet meadow and both willow (*Salix* spp.) and alder (*Alnus glutinosa*) carr (woodland) with an intersecting system of drainage ditches, reens and ponds are present. The site is an important breeding ground for water and marsh birds.

Rogiet Meadow SSSI

10.4.28 Rogiet Meadow SSSI is the only extant and recorded native site of meadow clary (*Salvia pratensis*) in Wales.

Penhow Woodlands SSSI and NNR

10.4.29 Penhow Woodlands SSSI includes two areas of ancient semi-natural woodland situated mainly on steep slopes and summits of limestone hills covered with superficial deposits of a calcareous nature. The dominant canopy tree species are lime (*Tilia cordata*), ash (*Fraxinus excelsior*), gean (*Prunus avium*), wych elm (*Ulmus glabra*), field maple (*Acer campestre*) and localised pendunculate oak (*Quercus robur*). The absence of birch (*Betula* spp.) and oak from much of the wood and the presence of a number of fine ancient pollarded trees along with a complex of parish boundaries are additional features. The ground flora includes a number of nationally rare and locally distributed species, including upright spurge (*Euphorbia serrulata*), green hellebore (*Helleborus viridis*), bird's nest orchid (*Neottia nidus-avis*) and wild daffodil (*Narcissus pseudonarcissus*).

Non-Statutory Designated Sites

10.4.30 Non-statutory designated sites are shown on Figure 10.3 and details of these sites are provided in Appendices 10.2, 10.17 and 10.34. Thirty eight non-statutory Sites of Importance for Nature Conservation (SINCs) are located within the study area. In addition, two Gwent Wildlife Trust reserves and one Royal Society for the Protection of Birds (RSPB) reserve are located within the study area. The closest non-statutory designated sites to the proposed new section of motorway are summarised below.

LG Duffryn Site 1 (South Lake Drive) SINC

10.4.31 The LG Duffryn Site 1 (South Lake Drive) SINC comprises a pond with a reedbed and supports Cetti's Warbler.

LG Duffryn Site 2 SINC

10.4.32 The LG Duffryn Site 2 SINC is a large area of neutral grassland adjacent to the Gwent Levels.

Afon Ebbw River SINC

10.4.33 The Afon Ebbw River SINC is a major river system with associated semi-improved neutral grassland and marshy grassland, swamp, scrub and semi-neutral woodland. Associated species include bulbous foxtail near the confluence with the River Usk, kingfisher, sand martin and grass snake.

Marshall's SINC

10.4.34 The Marshall's SINC comprises a mosaic of neutral grassland, post industrial land and wetland.

Solutia Site SINC

10.4.35 The Solutia Site SINC is a series of improved and semi-improved grasslands with traditional ditches and ponds. The site supports a range of species, including nesting birds such as Cetti's warbler and invertebrates such as hairy dragonfly.

Spencer Works 3 SINC

10.4.36 The Spencer Works 3 SINC in the Tata Lagoons area is designated for marshy grassland with wet drains.

Alpha Steel Site SINC

10.4.37 The Alpha Steel Site SINC is described as an area of former Levels, scrub and other habitats, which supports a range of species including scarce moth species, birds such as Cetti's warbler and plants including orchids. It largely comprises a series of sludge lagoons.

Spencer Works 3 SINC

10.4.38 The Spencer Works 3 SINC comprises marshy grassland with wet drains.

Elver Pill Reen Grassland and Pond SINC

10.4.39 The Elver Pill Reen Grassland and Pond SINC comprises a lagoon with a mosaic of swamp and marshy and dry semi-improved neutral grassland and supports Cetti's warblers.

Greenmoor Pool SINC

10.4.40 The Greenmoor Pool SINC was formerly standing water, which now supports reedswamp which itself supports bird populations including Cetti's warbler.

Bowkett Field, Barecroft SINC

10.4.41 The Bowkett Field, Barecroft SINC in the Bareland Street area is a large, linear, flat field, which comprises tall swamp/marshy grassland and appears to be overgrown and neglected. Around the field margins, the reens, particularly on the eastern edge, support mature willow scrub, and host many bird species. A small

piece of land at the entrance to the site (in the north) comprises overgrown willow scrub and some interesting herb species, including common knapweed and tall melilot which supports abundant invertebrate life.

Barecroft Fields SINC

10.4.42 The Barecroft Fields SINC in the Bareland Street area is formed of two large, flat fields, comprising semi-improved, relatively species-poor damp grassland/wet pasture. However, there are some localised and widespread patches of uncommon species such as common meadow rue and meadow thistle.

Land at Barecroft Common SINC

10.4.43 The Land at Barecroft Common SINC comprises three large, flat fields on the Gwent Levels at Magor. All the fields comprise semi-improved damp grassland, which is ungrazed/uncut and with a sward height of 70 – 100 cm. The reens adjacent to the field support aquatic species.

Upper Cottage Pond SINC

10.4.44 The Upper Cottage Pond SINC is described as a pond surrounded by agriculturally improved fields. It is grazed up to the margins and used for drinking by stock. The pond lacks diversity and the main interest lies with the abundance of whorl grass *Catabrosa aquatica*. There are mature oaks *Quercus robur* to the south of the pond.

Blue House Farm SINC

10.4.45 The Blue House Farm SINC comprises a botanically interesting tall mosaic of damp and dry grassland habitats, lying on fairly level ground and enclosed by ditches and reens. These ditches are accompanied along the north, west and much of the eastern boundary by bramble scrub and grown up hedges/tall tree lines. A potential native black poplar tree (coppiced) is located at the western edge of the northern most field.

Blackwall Lane Field SINC

10.4.46 The Blackwall Lane Field SINC is a small, horse grazed, flat meadow. The un-grazed half comprises tall species rich grassland with occasional hawthorn scrub establishing from the overgrown hedge with some mature/approaching veteran trees. The reen to the east supports a herb-rich community.

Grange Road SINC

10.4.47 The Grange Road SINC in the Magor area is formed of two fields, including a flat low lying field with a watercourse and a gentle to moderately sloping field towards the east of the site. The site includes an unmodified stream that runs north to south along the western boundary of the site. The fields include species-rich neutral grassland on the steeper slopes to the east of the site and semi-improved neutral grassland between the more diverse slope and the stream to the east. The richer grasslands include a range of forbs indicative of the unimproved nature of the ground.

Upper Grange Farm Field SINC

10.4.48 The Upper Grange Farm Field SINC is a species-rich grassy bank comprising some areas of rank, tussocky grass. This bank forms the south eastern boundary of a larger field comprising improved grassland, which is cattle grazed.

Nature Reserves

10.4.49 The nature reserves in the vicinity of the proposed new section of motorway are shown on Figure 10.3 and are the Newport Wetlands Nature Reserve, and the Magor Marsh and Great Traston Meadows Gwent Wildlife Trust Nature Reserves.

10.4.50 The Newport Wetlands reserve is managed as a partnership between Natural Resources Wales, the Royal Society for the Protection of Birds (RSPB) and Newport City Council and is located within the western part of the Newport Wetlands SSSI referred to above.

10.4.51 The Magor Marsh Gwent Wildlife Trust Reserve comprises the Magor Marsh SSSI referred to above together with two additional blocks of land within the Gwent Levels - Redwick and Llandevenny SSSI to the west.

10.4.52 The Great Traston Meadow Gwent Wildlife Trust Reserve is located to the south of Pye Corner. The main habitat is grazing marsh, with associated ditches, reens and grips. Pollarded willows line many of the reens. The site is important for its diversity of wetland and grassland plants, breeding birds and invertebrates. Much of the reserve is within the Gwent Levels – Nash and Goldcliff SSSI referred to above.

Habitats

10.4.53 The habitats mapped by the Arup and RPS Phase 1 habitat surveys (reports at Appendices 10.2 and 10.19) along the route of the new section of motorway are shown on Figure 10.4 and listed below (with the Phase 1 habitat codes). Locations referred to in the text are indicated on the figure.

10.4.54 The habitats are described in the Phase 1 habitat survey reports according to the relevant Phase 1 habitat type and summaries are provided below. Reference is also made to the reports of the NVC surveys (Appendices 10.4 and 10.20), aquatic macrophyte surveys (Appendix 10.14 and 10.30), River Corridor Survey (Appendix 10.32) and the waxcap survey (Appendix 10.33). The main habitat types identified were as follows.

- Woodland (A1) and scrub (A2).
- Grassland, including dry grassland (B2, B3, B4 and B6) and marshy grassland (B5).
- Swamp and reedbeds (E and F).
- Waterbodies (G), including standing water (G1) and running water (G2).
- Saltmarsh (H2).
- Boundaries (J2), including hedgerows (J2.1, J2.2) and dry ditches (J2.6).
- Other land uses, such as artificial exposures and waste tips (I2); cultivated/disturbed land (J1) including arable (J1.1) and amenity grassland

(J1.2); introduced shrub (J1.4); tall ruderal (C3); buildings (J3.6); and hard standing (J6).

Woodland and Scrub

10.4.55 As shown on the habitat survey plan at Figure 10.4, areas of woodland are relatively infrequent across the surveyed areas, typically comprising small, discrete units of broadleaved semi-natural woodland and broadleaved planation woodland. Lowland mixed deciduous woodland (including wet woodland) is a UK BAP/Section 42 habitat.

10.4.56 The larger areas of woodland are located within the Castleton area and to the north of Magor. At Berryhill Farm, a mature oak and ash woodland including old coppice stools is present.

10.4.57 Plantation woodland occurs mainly alongside the existing motorway and road network. The woodlands are predominantly broadleaved or mixed with species including hazel, hawthorn, ash and Scots pine.

10.4.58 The only areas of woodland that have been identified between the River Ebbw and Magor are one area of broadleaved woodland to the west of Pye Corner and the plantation/successional scrub woodlands at Pye Corner and within the Tata Steelworks. These successional woodlands are populated by hawthorn, crack willow, goat willow, white willow and bramble. These are primarily located in the old laboratory site at Pye Corner and within the former settlement lagoons within the Greenmoor area of the Tata Steelworks.

10.4.59 At the eastern section of the survey area, parcels of semi-natural woodland are present to the north of Magor, Undy and Rogiet.

10.4.60 There are many areas of scrub across the survey area. The dominant scrub species recorded is bramble but other species present include blackthorn and hawthorn, buddleia and grey willow with occasional scattered Japanese knotweed present in some areas. There are particularly large areas of scrub within the Tata Steelworks site and around Pye Corner, which are developing into woodland as described above.

10.4.61 Parkland and scattered trees are present in various areas, such as the Parc Golf Course in Coedkernew, near Moorbarn Farm to the south of the Tata Steelworks and near Church Farm in Wilcrick, north of Magor.

10.4.62 Woodlands at Pwll Diwaelod, Pound Hill, Berryhill Farm, Pye Corner, Magor Road, Roggiett Brake and Rectory Woods were included in the more detailed NVC/botanical surveys. An area of scrub at Fox Covert was also included in the survey. Other areas of scrub at Solutia, Green Moor, Alexandra Dock and Tata steelworks are described under ‘other habitats’ later in this section. The detailed survey data and descriptions of the woodlands are set out in the reports at Appendices 10.4 and 10.20.

10.4.63 Of the woodlands included in the NVC survey, the woodlands at Pwll Diwaelod, Berryhill Farm, Roggiett Brake and Rogiet Rectory Wood are considered to constitute UK BAP/Section 42 priority habitat. The smaller, more scrubby woodlands and plantations are not.

10.4.64 The woodlands at Pwll Diwaelod, Berryhill Farm, Pye Corner, Roggiett Brake and Rogiet Rectory Wood are included in the Forestry Commission Ancient Woodland Inventory. These woodlands are shown on the plan at Figure 10.5.

10.4.65 The three main areas of woodland at Pwll Diwaelod are classified as semi-natural ancient woodland and, in terms of NVC, range from alder-dominated W5 and W6, to drier W7 and W8 woodland. A few parts are currently in poor condition due to tipping and over-grazing, but they still retain a diverse structure and ground flora, and sufficient old woodland indicators to be evaluated as having county significance for nature conservation.

10.4.66 The woodland at Berryhill Farm retains large mature oak trees and significant patches with ancient woodland indicator species, resembling NVC W8 woodland community, but these features are in a relatively poor condition, with the ground flora having to compete with non-native invasive species, tipping and dense nettles.

10.4.67 The two woodlands at Roggiett Brake and Rogiet Rectory Wood have been subject to felling and replanting but still retain a mostly broadleaved canopy and a diverse ground flora with high proportion of old woodland indicator species, typical of the NVC W8 woodland community on limestone soils. The patches at Roggiett Brake where conifers are dominant contain a good range of indicators in their ground flora, and should still be considered to be of value for nature conservation in a county context.

10.4.68 The small scrubby plantation at Pye Corner includes a small part of an area that is shown as ancient semi-natural woodland in the ancient woodland inventory. However, with the exception of a narrow strip of mature trees beside Picked Lane there does not appear to be any evidence of old woodland. Aerial photographs from the 1940s clearly show that the study area was a field at that time, and most of the current canopy has clearly been planted relatively recently. This plantation is evaluated as being of local value for its flora.

10.4.69 The two areas of scrub and plantation at Pound Hill only have a species-poor ground flora with very common plant species. They were assessed as being of nature conservation value only in a local context.

10.4.70 The small woodland at Magor Road has a few elements of the NVC W8 woodland community but it has been substantially modified and generally has more in common with W21 scrub.

10.4.71 The Newport Local BAP includes a Woodland Habitat Action Plan, which covers a range of woodland types including Lowland Mixed Deciduous Woodland. The overall vision for the plan is to maintain, restore and extend these habitats in Newport. This is especially important within the context of habitat connectivity. The plan lists the following objectives.

- To positively manage and protect these woodland habitats in Newport, and connect and expand the habitats where possible.
- To maintain and expand the range and/or population of species associated with these habitat types.
- To identify and record priority areas of woodland habitats within Newport, outside SSSIs.

- To raise awareness of woodland habitats and the benefits they bring us.

10.4.72 The Monmouthsire Local BAP includes a Habitat Action Plan for Woodlands. The plan includes the following relevant actions.

- Ensure woodland sites are fully considered when assessing any development, which may impact upon the habitat.
- When there is no alternative ensure that appropriate mitigation or compensation measures for woodland are implemented during development.
- Where appropriate, ensure opportunities for enhancing woodland are used during the planning process.

10.4.73 The Trunk Road Estate BAP includes a Habitat Action Plan for Woodlands and Planted Native Trees and Shrubs. The objectives of this Action Plan are to:

- identify the presence of UK BAP woodland habitats within the network;
- avoid the further loss of woodland habitats along road verges;
- mitigate against the unavoidable loss of woodland habitat;
- maintain and enhance the existing woodland within the soft estate;
- maximise biodiversity within woodlands; and
- conserve existing roadside trees, shrubs and their associated habitat, where this does not conflict with road safety, or other ecological factors such as other biodiversity species requirements, or where there is a statutory requirement to maintain trees in a certain way.

10.4.74 The plan includes the following actions.

- At the design stage for new road and improvement schemes, ensure that valuable woodlands and trees, in particular UK BAP habitats and designated sites, are taken into consideration. Avoid the direct loss of valuable woodland habitat and individual trees wherever possible.
- Protect existing and retained woodland habitat during construction operations by the use of appropriate fencing, and by not stockpiling construction materials in these areas.
- Where the loss of woodland is unavoidable, consider options for mitigation and enhancement, including the extension of areas of existing woodland, or increasing connections with other woodland areas by the use of native planting. Translocation should only be considered as a last resort.
- Use only native species when carrying out planting and, where possible, stock of local or seed source zone provenance, ensuring that the species are used in ‘natural’ abundance and distributions. If appropriate, consider growing from seeds from particular sites.

10.4.75 Overall the plantation woodlands are valued at District (Low) value and the semi-natural woodlands at County (Medium) value.

Grassland

Dry and Marshy Grassland

10.4.76 Grassland is the most abundant broad habitat type across the survey area. There are extensive areas of improved grassland in the Castleton and Magor areas. Improved grassland is also extensive across the Gwent Levels where there are also areas of poor semi-improved grassland and semi-improved neutral grassland.

10.4.77 Marshy grassland occurs only locally within the western section of the survey area from Castleton through to Pye Corner. East of Pye Corner, marshy grassland becomes more evident.

10.4.78 These Gwent Levels grasslands, together with the reens and ditches, which divide the fields constitute Coastal and Floodplain Grazing Marsh UK BAP/Section 42 habitat (see below).

Coastal and Floodplain Grazing Marsh

10.4.79 A number of areas of grazing marsh were included in the NVC surveys. These were at Lighthouse Road, New Dairy Farm, Whitecross Farm, Solutia, Broadstreet Common, Tatton Farm, Green Moor Fields and Greenmoor Lane. The detailed survey data are set out in the reports at Appendices 10.4 and 10.20.

10.4.80 The majority of the grassland included within the survey area is managed as permanent pasture, some of which is left ungrazed during the spring to provide a hay crop. Grazing is mostly by cattle, but some fields have sheep or horses.

10.4.81 This is mostly classified as NVC MG6 and MG7 grassland and it generally has a fairly low botanical diversity. A few of the species in these grasslands are considered locally significant, such as meadow brome and meadow barley. In some areas there are patches of more botanical interest within fields, for example orchids and corky-fruited water dropwort at Broad Street Common, or tubular water dropwort in the field grips at New Dairy Farm. The damp field grips at Whitecross Farm and Tatton Farm graduated to NVC MG10 rush pasture, which locally support tubular water dropwort.

10.4.82 The most diverse grasslands within the surveyed sites tend to be those that are wetter and have been subject to lower levels of agricultural improvement. Within the survey areas, the main damp grassland types are NVC MG10 and MG23 rush pasture communities, which often form a transition with the adjacent grasslands. The most diverse examples of damp grassland are at Greenmoor Lane, where the grasslands form a transition to NVC M27 mire and M24 fen meadow, with notable species including meadow thistle, meadow rue, purple moor grass and brown sedge. These fields qualify as the UK BAP/Section 42 priority habitat Lowland Meadow.

10.4.83 Several grasslands appear to have received little or no recent management. These mainly belong to the NVC MG1 community, being dominated by one or two species of coarse grass and tall ruderal herbs. These are largely of limited value for their flora, but a few sites have notable species persisting from when they were grazed, for example pepper saxifrage in the overgrown fields beside the cycleway at Solutia.

10.4.84 The pasture sites within the Gwent Levels qualify as UK BAP/Section 42 priority habitat Coastal and Floodplain Grazing Marsh if considered together with the network of ditches. The grassland is of value in this context, even though its botanical diversity is limited.

10.4.85 The Newport Local BAP includes a Wetland Habitat Action Plan. This includes Coastal and Floodplain Grazing Marsh. The overall vision for the plan is to maintain, extend and improve the condition of wetland habitats within Newport and the BAP species associated with them. The Local BAP would also seek to promote the creation and maintenance of wetlands of biodiversity value as part of large developments such as road schemes and business parks, particularly where water attenuation facilities are required. Actions listed are as follows.

- To positively manage and protect these wetland habitats in Newport and connect and expand the habitats where possible.
- To maintain and where possible expand the range/and or population of species associated with these habitat types.
- To identify and record priority areas of wetland habitats within Newport, outside SSSIs.
- To raise awareness of wetland habitats and the benefits they bring us.

10.4.86 The Monmouthshire Local BAP includes a Habitat Action Plan for Species-rich Grasslands and Floodplain Pastures. This in turn includes Seasonally Flooded Pasture described as seasonally or permanently wet grasslands, usually agriculturally improved, found in coastal areas and on floodplains, which can be of value for their groundnesting birds (lapwing, curlew, redshank and snipe) and for wintering waterfowl and waders. They have few plants or invertebrates of conservation importance because they have mainly been drained, re-seeded and planted with ryegrass, but wildlife in adjacent ditches may be of interest.

10.4.87 The plan includes the following relevant actions.

- Ensure species rich grasslands and floodplain pastures are fully considered when assessing any development, which may impact upon the habitat paying particular attention to protected sites.
- Ensure opportunities for appropriate mitigation during development are used when avoidance is not an option.
- Ensure opportunities for enhancing species rich grassland and floodplain pastures during the planning process.

10.4.88 The Trunk Roads Estate BAP includes a Habitat Action Plan for Coastal and Estuarine Habitats which in turn includes Coastal and floodplain grazing marsh. The objectives of the plan are to increase awareness of the value and vulnerability of coastal and estuarine habitats; and to establish a greater consideration of the impacts of road construction on these habitats. Relevant actions included in the plan are as follows.

- Ensure that valuable habitats (particularly protected sites and UK BAP habitats) are considered at the design stage of new road and improvement schemes; seek advice from the Environment Agency Wales and CCW (now both incorporated into NRW) to help identify and resolve relevant issues.

- Ensure avoidable impacts do not occur to estuarine and coastal habitats during road construction.
- During operation and maintenance of the road, reduce the impacts of pollution to a minimum by ensuring that drainage systems are kept functional at all times.

10.4.89 Almost all of these grasslands (the only exception being the Solutia fields) are within the Gwent Levels SSSIs. The coastal and floodplain grazing marsh habitat as a whole is thus considered to be of National (High) value.

Lowland Meadow

10.4.90 Grassland sites (other than those within the Gwent Levels described above under coastal grazing marsh), which were included in the NVC survey were at Pwll Diwaelod, Pound Hill and Magor Road. The detailed survey data are set out in the reports at Appendices 10.4 and 10.20.

10.4.91 NVC MG5 grassland is only present in a few of the selected sites; the largest of these is at Pound Hill. The Wildlife Sites Guidelines (South Wales Wildlife Sites Partnership 2004) indicate that all examples of MG5 grassland should be considered for selection. The grassland at Pound Hill qualifies as the UK BAP/Section 42 priority habitat Lowland Meadow.

10.4.92 The ungrazed road verge habitat adjacent to the A48M and existing M4, seen at Pound Hill and adjacent to Pwll Diwaelod, supports moderately diverse NVC MG1 grassland. These areas are dominated by tall grasses, but they include a good range of herb species. It is possible that some of the diversity has been boosted by use of wildflower seed mix. Notable species recorded at Pound Hill include stone parsley, grass vetchling and yellow wort. Grass vetchling was also noted in the verge grassland adjacent to Pwll Diwaelod. These verges are considered to be of local value for nature conservation.

10.4.93 Cattle-grazed NVC MG6 grassland was found outside of the Gwent Levels at Pwll Diwaelod. This was mostly species-poor, but locally a few drier patches graduated into slightly more diverse MG5 grassland, while some damper areas support species-poor MG10 rush pasture. MG5 grassland is present adjacent to the Rectory Woods study site at Rogiet, which is close to the Rectory Meadow - Rogiet SSSI. The nearby SSSI is notified for meadow clary, but there was no sign of this rare plant within the current area. The pasture at these sites is considered to be of no more than local importance for nature conservation.

10.4.94 The Newport Local BAP includes a Lowland Grassland and Heathland Action Plan. This in turn includes Lowland Meadows.

10.4.95 The overall vision for the plan is to maintain, restore and extend these habitats in the county and the BAP species associated with them. This is especially important within the context of habitat connectivity within the Newport landscape. Actions listed are as follows.

- To positively manage these grassland and heathland habitats in Newport and connect and expand them where possible.
- To maintain and expand the range and/or population of species associated with these habitat types.

- To identify and record priority areas of grassland and heathland habitats within Newport.
- To raise awareness of grassland and heathland habitats and the benefits they bring us.

10.4.96 As explained above under Coastal and Floodplain Grazing Marsh, the Monmouthshire Local BAP includes a Habitat Action Plan for Species-Rich Grasslands And Floodplain Pastures. This includes Lowland Neutral Grassland. The relevant actions are as set out above.

10.4.97 The Trunk Roads Estate BAP includes a Lowland Meadows Habitat Action Plan. The objective of this Action Plan is to conserve and enhance the conservation of lowland meadow habitat within road verges. Specifically, to:

- protect, maintain and enhance the conservation value of the lowland meadow habitats within the soft estate;
- avoid further losses of lowland meadow habitats in future road construction and road improvement schemes;
- ensure that unavoidable impacts on lowland meadow habitats are fully mitigated either through the creation of alternative habitats, or through the sensitive management of adjacent highway verges;
- raise awareness of those involved in the design, construction and maintenance of roads of the conservation value of these lowland meadow habitats and to provide detailed information on how to promote these habitats; and
- improve suitable areas which do not currently support valuable grassland habitats such as a lowland meadow habitat.

10.4.98 Relevant actions in the plan are as follows.

- At the design stage for new road and improvement schemes, ensure that valuable lowland meadows are taken into consideration. Avoid the direct loss of lowland meadow habitat wherever possible.
- Phase out the use of seed that is not of local or seed source zone provenance.
- Where the loss of lowland meadow habitat is unavoidable, consideration should be given to the creation of a similar meadow habitat on the road verge or, as a last resort, translocation.

10.4.99 The waxcap survey (Appendix 10.33) identified a total of eight species of waxcap at the Pwll Diwaelod site and seven species at the Pound Hill site.

10.4.100 Based on the guidance of the Wales Wildlife Sites Guidelines (Wales Biodiversity Partnership, 2008) the survey findings indicate that both sites would qualify as being of at least local importance for their grassland fungi. If the number recorded in a single visit is used, then both sites would appear to reach the county importance threshold, with eight species seen during a single visit to Pwll Diwaelod and six at Pound Hill. However, this is a rather crude method and very dependent on the conditions and time of year of the visit.

10.4.101 Based on the older Guidelines for the Selection of Wildlife Sites in South Wales (the South Wales Wildlife Partnership, 2004), the Pwll Diwaelod site (a total of

eight species of waxcap) would be considered for selection and the Pound Hill site (a total of seven species) would not. The SSSI selection criteria, for identifying sites that are important in a national context, include a similar approach, but require a total of at least eighteen species, or twelve in a single visit (Genny, D. R., *et al*, 2009). Neither site is close to this threshold.

10.4.102 The Newport Local BAP includes a Fungi Action Plan. This is primarily concerned with waxcaps and other grassland fungi. The plan includes the following relevant action.

- To ensure that surveys are undertaken to inform decision making/planning of any plan or project that has the potential to affect fungi.

10.4.103 The Monmouthsire Local BAP includes species action plans for Pink Waxcap and Olive Earth Tongue grassland fungi.

10.4.104 The majority of the lowland grassland habitat recorded is of no more than District (Low) value. The grasslands at Pound Hill and Pwll Diwaelod are of County (Medium) value on account of their grassland vegetation and waxcap fungi respectively. The locations of the grassland at Pound Hill and Pwll Diwaelod are shown on Figure 10.5.

Swamp and Reedbeds

10.4.105 As can be seen on the habitat survey plan at Figure 10.4, there are large areas of swamp habitat within the Tata Steelworks associated with the settlement and water treatment lagoons. The swamp habitat at the western end of Tata Steelworks is predominantly beds of common reed and is part of the water treatment system for the steelworks. The areas of swamp mapped in the central area and further east of the Tata Steelworks are both managed and unmanaged reedbeds and the unmanaged areas are at various stages of succession of scrub encroachment predominantly by sedge and willow species.

10.4.106 Marginal and inundation habitat is also present in patches within the steelworks on the periphery of waterbodies and swamp areas, although not all was mapped at the scale of the Phase 1 habitat survey.

10.4.107 Reedbed is a UK BAP/Section 42 habitat. The reedbeds in the western part of the Tata Steel land were included in the NVC survey. The detailed survey data are set out in the report at Appendix 10.20. The reedbeds were mostly very species-poor, with very few associated species. The reed dominated vegetation would be categorised as NVC community S4 *Phragmites australis* swamp and reedbed.

10.4.108 Also included in the NVC survey were ponds at Pencarn mostly appearing to comprise shallow water, which is dominated by either common reed or bulrush. In some ponds there are drier areas that are becoming shaded by grey willow scrub. The detailed survey data are set out in the report at Appendix 10.4 and are summarised here.

10.4.109 In terms of the NVC, the reed-dominated ponds are classified as S4 *Phragmites australis* swamp, and the bulrush dominated ponds as S12 *Typha latifolia* swamp. The drier margins becoming invaded by willow are developing towards W1 *Salix cinerea – Galium palustre* woodland. The open water areas appear to

be the A2 *Lemna minor* community, and possibly also the A3 *Spirodela polyrhiza – Hydrocharis morsus-ranae* community.

10.4.110 The extensive Tata steelworks reedbeds form part of its effluent treatment system. Smaller reedbeds are present in other parts of the steelworks site and beside the Ebbw saltmarsh. Reedbeds have a limited botanical diversity but are recognised as having value for nature conservation for other taxa, such as birds and invertebrates and are a UK BAP/Section 42 priority habitat. These larger reedbed areas are considered important for nature conservation in a county context.

10.4.111 Many of the reens and ditches in the study area support relatively species poor common reed (S4 reedbed) or bulrush (S12 swamp) habitat. These reedbeds and other tall herb swamp qualify as UK BAP/Section 42 priority habitat. The reens and ditches are an important component of the Gwent Levels SSSIs.

10.4.112 As explained above under Coastal and Floodplain Grazing Marsh, the Newport Local BAP includes a Wetland Habitat Action Plan. This includes reedbeds. The overall vision and relevant actions of this plan are as set out above.

10.4.113 The Trunk Road Estate BAP includes a Habitat Action Plan for Waterbodies. This includes Reedbeds. The objectives of this Habitat Action Plan are to protect waterbodies on or adjacent to the soft estate, as well as implementing appropriate management plans for them. Relevant actions of the plan are as follows.

- At the design stage for new road and improvement schemes, ensure that valuable waterbodies, in particular UK BAP habitats and designated sites, are taken into consideration. Avoid the direct loss of waterbodies wherever possible.
- Take into account during design and construction indirect effects of drainage or alterations to ground water on surrounding waterbodies.

10.4.114 The swamp and reedbed habitats are considered to be of County (Medium) value.

Waterbodies

Rivers

10.4.115 The proposed new section of motorway would cross the Rivers Usk and Ebbw. Rivers are a UK BAP/Section 42 habitat.

10.4.116 The River Usk is a tributary of the Severn Estuary and the tidal limit extends upstream approximately 29 km to the weirs at Newbridge on Usk. The River Usk is flanked by intensively developed land within the city of Newport and the Newport Docks areas, and through Newport the course of the River Usk is anthropogenically controlled by piled walls and wharves. Along the tidally influenced banks of the Usk, the river is bounded by the extensively developed land of Newport and Caerleon and open spaces with flood protection.

10.4.117 The strong tidal currents of the Usk erode and transport large quantities of fine sediment during spring tides, but during neap tides much of this sediment is deposited on the bed, forming very soft or fluid mud deposits, that are remobilised on the next spring tides. There are significant mud accumulations at

the mouth of the River Usk and the channel mouth is regularly dredged in order to maintain access to Newport Docks.

10.4.118 In the lower reaches of the estuary, the Uskmouth coastline through to the Goldcliff promontory is fronted by areas of both locally accreting and locally eroding saltmarsh.

10.4.119 The River Ebbw is in the western part of Newport and converges with the Usk just before entering the Severn Estuary.

10.4.120 There are a number of streams within the Castleton, Coedkernew and Magor areas, which are small watercourses which do not form part of the managed drainage system of the Gwent Levels and are therefore distinct from reens.

10.4.121 The Newport Local BAP includes a Freshwater Habitat Action Plan, which in turn includes Rivers and Streams. The overall vision for this plan is to maintain, restore and enhance these freshwater habitats in the county and the BAP species associated with them. The ability of watercourses to function as effective wildlife corridors is a principal objective, creating networks wherever possible to ensure habitat connectivity. There is also a desire to increase the number of wildlife ponds where the site is suitable.

10.4.122 The plan lists the following objectives.

- To positively manage and protect these freshwater habitats in Newport, and connect the habitats where possible.
- To maintain and expand the range and/or population of species associated with these habitat types, through creation or expansion of freshwater habitats e.g. ponds.
- To identify and record priority areas of freshwater habitats within Newport, outside SSSIs.
- To raise awareness of freshwater habitats and the benefits they bring us.

10.4.123 The Trunk Road Estate BAP includes a Rivers and Streams Habitat Action Plan. The objectives of the plan are as follows:

- to minimise the impacts of the road network on rivers and streams for road development (loss and disturbance through new schemes and through maintenance) and;
- to ensure the quality of rivers and streams, and riparian bank-side habitat, is maintained both as habitat in its own right, and as wildlife corridors.

10.4.124 The plan includes the following relevant actions.

- At the design stage of any scheme, ensure that watercourses, particularly those supporting protected species, are taken into consideration. Liaise with organisations such as the Environment Agency to identify relevant issues, and avoid the direct loss of riverine habitat (e.g. through inappropriate culverting).
- Before road schemes commence, take into account drainage issues and potential changes in groundwater, and any likely/potential effects on local watercourses.

- Maintain and develop pollution controls, in line with best practice, to stop untreated road runoff and vehicle pollution seeping into nearby watercourses.

10.4.125 The rivers habitat of the River Usk is of National (High) value based on the SSSI designation. Although also included in the River Usk SAC, the tidal river habitat is not an SAC feature. The River Ebbw is designated as a SINC and is of County (Medium) value. Other streams are of no more than District (Low) value. The reens and ditches of the Gwent Levels are considered under Eutrophic Standing Waters below.

Ponds

10.4.126 Ponds are shown on the habitat survey plan at Figure 10.4 and were recorded at Druidstone, in the Castleton area, in the Coedkernew area, to the east of the River Usk, within the Solutia land, within the Tata Steelworks, in the Knollbury area at Upper Grange Farm and in the Rogiet area. There are also waterbodies within the Newport Landfill site and Household Waste Recycling Centre.

10.4.127 Ponds are a UK BAP/Section 42 habitat.

10.4.128 The Newport Local BAP includes a Freshwater Habitat Action Plan, which includes ponds. The overall vision of this plan is to maintain, restore and enhance freshwater habitats in the county and the BAP species associated with them. The ability of all watercourses to function as effective wildlife corridors is a principal objective, creating networks wherever possible to ensure habitat connectivity. The plan also seeks to increase the number of wildlife ponds where the site is suitable.

10.4.129 The objectives set out in the plan are as follows.

- To positively manage and protect these freshwater habitats in Newport, and connect the habitats where possible.
- To maintain and expand the range and/or population of species associated with these habitat types, through creation or expansion of freshwater habitats e.g. ponds.
- To identify and record priority areas of freshwater habitats within Newport, outside SSSIs.
- To raise awareness of freshwater habitats and the benefits they bring us.

10.4.130 The Trunk Road Estate BAP includes a Waterbodies Habitat Action Plan, which includes Ponds. The objectives of the plan are to protect waterbodies on or adjacent to the soft estate, as well as implementing appropriate management plans for them.

10.4.131 The relevant actions of the plan are as follows.

- At the design stage for new road and improvement schemes, ensure that valuable waterbodies, in particular UK BAP habitats and designated sites, are taken into consideration. Avoid the direct loss of waterbodies wherever possible.
- Take into account during design and construction indirect effects of drainage or alterations to ground water on surrounding waterbodies.

- Monitor the condition of rivers and streams on and adjacent to the soft estate to ensure maintenance of quality following improvement or major maintenance, or where there are specific identifiable issues of biodiversity concern. Where significant effects remain after mitigation, consider whether retro-fitted measures can be applied.

10.4.132 The pond habitat is considered to be of County (Medium) value.

Eutrophic Standing Waters

10.4.133 As shown on the habitat survey plan at Figure 10.4, reens and ditches (both standing and slow flowing running water) are present throughout the Gwent Levels section of the survey area. The reens and ditches within the Gwent Levels SSSIs are main features for which the SSSIs have been designated.

10.4.134 There is a network of reens/ditches to the west of Church Lane, Coedkernew, which continues east through to the River Ebbw. Many of the reens/ditches are shaded by hawthorn dominated hedgerows.

10.4.135 To the east of the River Usk, the network of reens/ditches forming the majority of the field boundaries extends eastwards from the industrial area to the east of Newport Docks, continuing east south of the Tata Steelworks, and then further east towards Magor.

10.4.136 A total of 36 sites, plus four control sites, were surveyed for aquatic macrophytes within the survey corridor in 2014 (Appendix 10.14). A total of 81 species of aquatic macrophyte were recorded from the ditches, reens and ponds surveyed. Species-richness per site varied from two species to 32 species. The majority of the plant species recorded are common throughout the UK.

10.4.137 Tubular water dropwort was recorded, which is a UK BAP/Section 42 species and is listed under the International Union for Conservation of Nature (IUCN) rarity criteria as 'Vulnerable'. This species was recorded from five locations.

- Site 1: Neways Reen — Whitson SSSI
- Site 5: Reen parallel to North Row — Redwick and Llandevenny SSSI
- Site 19: Reen parallel to Old Dairy Reen — St Bride's SSSI
- Site 20: Old Dairy Reen — St Bride's SSSI
- Site 37: Reen close to River Ebbw — St Bride's SSSI

10.4.138 During the 2015 aquatic macrophyte survey (Appendix 10.30) samples were taken at a total of 40 sampling points in areas not previously surveyed during 2014. These sample points covered main rivers, reens and field ditches.

10.4.139 Where reens were not covered by specific sampling points, but aquatic macrophyte data was collected during the river corridor survey, this data was also analysed (an additional four sample points).

10.4.140 For the purposes of analysis, the sample sections were assigned a diversity score and a rarity score in accordance with the Botanical Survey of Reens, Gwent Levels (CCW, 1991) which provides categories for both scores. These two categories were then taken into account and the highest of the two was used to provide an overall assessment of the sample section or, in the case of the River Corridor Surveys, per 300 metre sample length.

10.4.141 The 2015 survey identified the following.

- Two sample stations with very high overall rating in terms of botanical diversity.
- Twelve sample stations with a high overall rating in terms of botanical diversity.
- Fourteen sample stations with a moderate overall rating in terms of botanical diversity.
- Twelve sample stations with a low overall rating in terms of botanical diversity.

10.4.142 A total of eighteen nationally or locally rare species were found during the survey. Of these species, the following was noted.

- Two were rare within the UK.
- Seven were rare within Wales.
- Four were rare within Gwent.
- Five were locally distributed in Wales.

10.4.143 Table 10.6 below provides a summary of diversity scores and categories along with the rarity scores and categories. The overall rating for each sample section is then given based upon the highest rating of the two scores.

Table 10.6: Summary of Overall Rating of Reens in Terms of Botanical Diversity

Sample Section Reference	Diversity Score	Diversity Category	Rarity score	Rarity Category	Overall rating in terms of botanical diversity.
R1	3	Low	0	Low	Low
R2	10	Low	0	Low	Low
R3	5	Low	0	Low	Low
R4	11	Moderate	0	Low	Moderate
R5	19	Moderate	27	High	High
R6	13	Moderate	25	High	High
R7	13	Moderate	22	High	High
R8	8	Low	1	Low	Low
R9	4	Low	5	Low	Low
R10	4	Low	8	Low	Low
R11	12	Moderate	4	Low	Moderate
R12	7	Low	5	Low	Low
R13	9	Low	4	Low	Low
R14	7	Low	0	Low	Low
R15	9	Low	4	Low	Low
R16	11	Moderate	12	Moderate	Moderate
R17	10	Low	20	Moderate	Moderate
R18	11	Moderate	19	Moderate	Moderate
R19	5	Low	4	Low	Low
R20	14	Moderate	19	Moderate	Moderate
R21	9	Low	17	Moderate	Moderate
R22	15	Moderate	20	Moderate	Moderate
R23	21	High	30	High	High
R24	23	High	31	Very High	Very High
R25	18	Moderate-	30	High	High

Sample Section Reference	Diversity Score	Diversity Category	Rarity score	Rarity Category	Overall rating in terms of botanical diversity.
		High			
R26	8	Low	13	Moderate	Moderate
R27	8	Low	17	Moderate	Moderate
R28	8	Low	5	Low	Low
R29	8	Low	20	Moderate	Moderate
R30	21	High	25	High	High
R31	24	High	24	High	High
R31a	22	High	39	Very High	Very high
R32	18	Moderate-High	21	High	High
R33	22	High	26	High	High
R34	13	Moderate	25	High	High
R35	18	Moderate	28	High	High
R36	23	High	14	Moderate	High
R37	15	Moderate	15	Moderate	Moderate
R38	9	Low	13	Moderate	Moderate
R39	12	Moderate	17	Moderate	Moderate
RCS1	29	High	41	Very High	Very High
RCS2	25	High	18	Moderate	High
RCS3	16	Moderate-High	10	Low	Moderate-High
RCS4	39	High	38	Very High	Very High

10.4.144 Those sample sections with high or very high botanical diversity scores are shown on the plans at Figure 10.5.

10.4.145 A total of eighteen nationally or locally rare species were found during the survey. Table 10.7 below summarises the records of nationally or locally rare species in the sampled watercourses. The species' status as given in the Vascular Plant Red Data Book (Cheffing and Farrell, 2005) and the Wildlife Sites Guidance Wales (Wales Biodiversity Partnership, 2008) is shown. Where the Red Data Book status in Wales (Dines, 2008) differs from the UK status this is given in brackets. Tubular water dropwort is included in the Section 42 list of species of principal importance for biodiversity in Wales.

Table 10.7: Summary of the Locations of Rare and Scarce Species in Aquatic Macropyhtes Survey

Latin name	English name	Total number of sample areas where species found	Sample areas where species found
Wolffia arrhiza	Rootless duckweed	1	RCS1
Potamogeton trichoides	Hairlike Pondweed	22	R5, R6, R7, R16, R17, R18, R20, R21, R23, R24, R25, R26, R27, R29, R30, R31a, R33, R34, R35, R39, RCS1, RCS4
Alisma lanceolata	Narrow leaved water plantain	3	R31a, RCS1, RCS4
Oenanthe fistulosa	Tubular water-dropwort	7	R23, R24, R25, R36, RCS1, RCS2, RCS4

Latin name	English name	Total number of sample areas where species found	Sample areas where species found
Zanichella palustris	Horned pondweed	1	R31a
Sagittaria sagittarius	Arrowhead	9	R5, R6, R7, R23, R24, R25, RSC2, RSC3, RSC4
Potamogeton pusillus	Lesser Pondweed	12	R5, R6, R7, R22, R27, R31, R31a, R32, R33, R34, R35, R37
Spirodela polyrhiza	Greater duckweed	36	R5, R6, R9, R10, R11, R12, R13, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R31a, R32, R33, R34, R35, R36, R37, R38, R39, RSC1, RSC2, RSC4
Hydrocharis morsus-ranae	Frogbit	24	R5, R6, R7, R17, R18, R20, R22, R23, R24, R25, R30, R31, R31a, R32, R33, R34, R35, R36, R37, R38, RCS1, RCS2, RCS3, RCS4
Ceratophyllum demersum	Rigid hornwort	20	R5, R10, R17, R18, R20, R22, R23, R24, R25, R29, R30, R31, R31a, R32, R33, R34, R35, R37, R38, RSC4
Catabrosa aquatica	Whorl grass	2	R31, R32,
Carex pseudocyperus	Cyperus Sedge	5	R22, R30, R31, R31a, R35
Potamogeton berchtoldii	Small pondweed	2	R21, RCS4
Butomus umbellatus	Flowering-rush	2	RCS2, RCS4
Lemna gibba	Fat duckweed	22	R8, R9, R10, R12, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R31a, R32, R33, R38, R39, RCS1, RCS4
Lemna trisulca	Ivy-leaved duckweed	20	R6, R7, R21, R22, R23, R24, R25, R29, R30, R31, R31a, R32, R33, R34, R35, R36, R39, RCS1, RCS3, RCS4
Rumex hydrolapathum	Great water dock	9	R7, R24, R30, R31, R31a, R32, R34, R35, R38,
Veronica catenata	Pink water speedwell	2	R17, R39

Status abbreviations: Least Concern (LC), Nationally Scarce (NS), Near Threatened (NT), Nationally Rare (NR), Vulnerable (VU), Endangered (EN) or Critically Endangered (CR) in the Red Data Book.

10.4.146 The River Corridor Survey report (Appendix 10.32) provides baseline information for the nineteen watercourses surveyed between August and October 2015. The reens surveyed during the RCS survey period were at various stages and types

of management. Each reen provides different ecological niches potentially supporting a diverse range of wildlife.

10.4.147 The Newport Local BAP includes a Wetland Habitat Action Plan. This includes Coastal and Floodplain Grazing Marsh with the associated reens and ditches. The overall vision for the plan is to maintain, extend and improve the condition of wetland habitats within Newport and the BAP species associated with them. The Local BAP also seeks to promote the creation and maintenance of wetlands of biodiversity value as part of large developments such as road schemes and business parks, particularly where water attenuation facilities are required.

10.4.148 The objectives set out in the plan are as follows.

- To positively manage and protect these wetland habitats in Newport and connect and expand the habitats where possible.
- To maintain and where possible expand the range/and or population of species associated with these habitat types.
- To identify and record priority areas of wetland habitats within Newport, outside SSSIs.
- To raise awareness of wetland habitats and the benefits they bring us.

10.4.149 The Trunk Road Estate BAP includes a Rivers and Streams Habitat Action Plan. The objectives of this Action Plan are:

- to minimise the impacts of the road network on rivers and streams for road development (loss and disturbance through new schemes and through maintenance) and;
- to ensure the quality of rivers and streams, and riparian bank-side habitat, is maintained both as habitat in its own right, and as wildlife corridors.

10.4.150 The relevant actions of this plan are as follows.

- At the design stage of any scheme, ensure that watercourses, particularly those supporting protected species, are taken into consideration. Liaise with organisations such as the Environment Agency to identify relevant issues, and avoid the direct loss of riverine habitat (e.g. through inappropriate culverting).
- Before road schemes commence, take into account drainage issues and potential changes in groundwater, and any likely/potential effects on local watercourses.
- Maintain and develop pollution controls, in line with best practice, to stop untreated road runoff and vehicle pollution seeping into nearby watercourses.

10.4.151 All of the reens and ditches surveyed are within the Gwent Levels SSSIs and are main features for which the SSSIs have been designated. The reen system is consequently of National (High) value.

Saltmarsh

10.4.152 Saltmarsh was mapped along both the River Usk and River Ebbw as shown on the habitat survey plan at Figure 10.4. Coastal saltmarsh is a UK BAP/Section 42 habitat.

10.4.153 All of the areas of saltmarsh on the line of the proposed new section of motorway (River Ebbw west and east banks and the River Usk east bank) were subject to NVC survey. The detailed survey data are set out in the reports at Appendices 10.4 and 10.20.

10.4.154 The saltmarshes on the west bank of the Ebbw and east bank of the Usk both support stands of typical saltmarsh vegetation that include locally uncommon species, and qualify as UK BAP/ Section 42 priority habitat. Both sites are fringed by NVC SM13 saltmarsh community vegetation in their lower parts, but the grazed upper parts of the Ebbw supports short SM16 saltmarsh vegetation, including the nationally scarce bulbous foxtail, while the ungrazed upper parts of the Usk saltmarsh site are dominated by much taller sea couch SM24 vegetation.

10.4.155 Much of the east bank of the Ebbw is unmanaged and largely dominated by dense scrub and reedbeds with limited vegetation diversity. However, the strip of low growing vegetation in the vicinity of the Scheme supports a diverse saltmarsh flora, which is UK BAP/Section 42 priority habitat. The saltmarsh is a little unusual in this location because much of it is formed over stony material, but the flora is relatively diverse and includes a good range of typical saltmarsh plants, grading into grassland and scrub further up the shore.

10.4.156 The River Usk east bank saltmarsh is included in the River Usk (Lower Usk) SSSI and also in the River Usk SAC (although not one of the features for which the SAC is designated). It is also part of the Marshall's SINC.

10.4.157 The Newport Local BAP includes a Marine and Coastal Habitat Action Plan. This includes a section on Coastal Saltmarsh.

10.4.158 The overall vision for the plan is to maintain and enhance these coastal habitats and the BAP species associated with them. The plan lists the following objectives.

- To ensure that there is no loss in extent and quality of marine and coastal habitats and so that increases in habitat extent and quality are possible.
- To maintain and expand the range and/or population of species associated with these habitat types.
- To identify and record priority areas of marine and coastal habitats and associated species.
- To raise awareness of marine/coastal species and the benefits they bring us.

10.4.159 As explained above under Coastal and Floodplain Grazing Marsh, the Trunk Roads Estate BAP includes a Habitat Action Plan for Coastal and Estuarine Habitats. This includes saltmarshes. The objectives and relevant actions of the plan are set out above.

10.4.160 The saltmarsh on the east bank of the River Usk is part of the River Usk (Lower Usk) SSSI. It is also within the River Usk SAC but is not one of the features for which the SAC is designated. It is thus valued at the National (High) level. The saltmarshes on the banks of the River Ebbw are valued at the County (Medium) level.

Intertidal Mudflats

10.4.161 As shown on the habitat survey plan at Figure 10.4 and the plan of intertidal habitats at Figure 10.6, there are intertidal mudflats within the channels of the Rivers Ebbw and Usk. Intertidal mudflats is a UK BAP/Section 42 habitat.

10.4.162 The intertidal areas of the River Usk are characterised by intertidal mud and saltmarsh habitats (see above) with patchy areas of fucoids in the lower intertidal, particularly around the Newport Docks area, and patchy algal turf at the mouth of the River Usk (CCW, 2010; OSPAR, 2014) (see Figure 10.6). The CCW (2010) intertidal lifeforms data also indicate the presence of fucoids on the intertidal banks of the River Usk, most notably on the east bank to the south of the proposed route for the new section of motorway. The fucoid communities in the River Usk are likely to be associated with areas of dumped rubble/rock armour as well as the walls of the eastern dry dock and old quay legs. CCW surveys from 2002 recorded a number of species of fucoid seaweeds from this part of the River Usk including *Fucus vesiculosus* and *F. spiralis*. During the same surveys, barnacles including *Balanus crenatus* and common mussel *Mytilus edulis* were also recorded, likely to be on the localised areas of hard substrate and shoreline structures (CCW, 2006).

10.4.163 Estuarine intertidal mud habitat in the River Usk qualifies as an OSPAR priority habitat (Intertidal Mudflats; OSPAR, 2014) and UK BAP priority habitat/Section 42 habitat of principal importance in Wales. Site condition monitoring of the intertidal mud and sandflats of the Severn Estuary/Môr Hafren SAC and SPA in 2012 (EcoSpan, 2012) included the area around the mouth of the River Usk and indicated that the communities in the littoral muddy sediments in these areas are characterised by biotopes containing the Baltic tellin *Macoma balthica*; this mollusc is considered to be an important prey item for birds and benthic fish and crustacean species. This study also noted the presence of *Sabellaria alveolata* reefs in the area to the east of the mouth of the River Usk at Usk Patch (EcoSpan, 2012). CCW surveys of the River Usk in 2002 also noted similar infaunal species including ragworm *H. diversicolor* and *M. balthica*, in addition to other polychaetes such as *Nephtys hombergii* and *Streblospio shrubsolii* which is common from muddy shores and brackish waters (CCW, 2006).

10.4.164 Similar to the River Usk, the intertidal areas of the River Ebbw are characterised by intertidal mud, with small patches of algal turf on localised areas of rock armour/rubble, and saltmarsh habitats (CCW, 2010; OSPAR, 2014; see Figure 10.6). Estuarine mud habitats in the River Ebbw qualify as an OSPAR priority habitat (Intertidal Mudflats; OSPAR, 2014), UK BAP priority habitat and Section 42 habitat of principal importance in Wales. Throughout the lower reaches of the River Ebbw, in the vicinity of the proposed new section of motorway, there are numerous areas of dumped rubble which support sparse communities of green algae. There are also numerous makeshift jetties made from scaffolding and old barrels towards the lower reaches of the river running from the saltmarsh down to the bottom of River Ebbw channel.

10.4.165 Although the site condition monitoring of the intertidal mud and sandflats of the Severn Estuary/Môr Hafren SAC and SPA in 2012 did not fully extend into the reaches of the River Ebbw, it is considered likely that the intertidal communities present in this area will be characterised by similar species (i.e. *M. balthica*) and the same biotope as recorded at the mouth of the River Usk. CCW surveys of the River Ebbw in 2002 also noted similar infaunal species including ragworm *H.*

diversicolor and the peppery furrow shell *Scrobicularia plana* which is able to tolerate low salinities in thick mud or muddy sand (CCW, 2006). As explained for saltmarsh above, the Newport Local BAP includes a Marine and Coastal Habitat Action Plan. This includes a section on Intertidal Mudflats. The overall vision and the objectives of the plan are set out above.

10.4.166 As explained above for Coastal and Floodplain Grazing Marsh, the Trunk Roads Estate BAP includes a Habitat Action Plan for Coastal and Estuarine Habitats. This includes Mudflats. The objectives and relevant actions of the plan are set out above.

10.4.167 As set out for saltmarsh above, the intertidal muds of the River Usk are part of the River Usk (Lower Usk) SSSI. They are also within the River Usk SAC but are not one of the features for which the SAC is designated. They are thus valued at the National (High) level. The intertidal muds of the River Ebbw are valued at the County (Medium) level.

Subtidal Habitats

10.4.168 The subtidal sediments in the centre of the river channel in the lower reaches of the River Usk are dominated by muddy sediments. Subtidal mixed muddy sediments are a UK BAP/Section 42 habitat.

10.4.169 The fauna of principal rivers of the Severn Estuary (e.g. the River Usk) is reported to be similar to that of the soft sediments of the Severn itself (Morrisey *et al.*, 1994) with communities in these river estuaries dominated by the polychaete *Nereis diversicolor*, the amphipod *Corophium volutator*, the mollusc *M. balthica* and a variety of oligochaetes (Langston *et al.,* 2003). Benthic data collected for Water Framework Directive operational monitoring purposes by the Environment Agency in 2011 at sites near the mouth of the River Usk Estuary support this conclusion with *M. balthica* and *Nephtys* spp. dominating the grab samples in this area.

10.4.170 Subtidal benthic biotopes, as mapped by the CCW HABMAP project (2010), are shown on Figure 10.7 and show that communities associated with the muddy sediments in these areas are largely characterised by the sublittoral mud in variable salinity biotopes with small patches of *Capitella capitata* in enriched sublittoral muddy sediments on the western bank of the River Usk in the area immediately to the east of Newport Docks. This biotope also dominates the sediment at the mouth of the River Usk estuary and extends into the Severn Estuary.

10.4.171 The subtidal sediments in the main channel of the lower reaches of the River Ebbw are similar to those in the River Usk and the wider Severn Estuary (Figure 10.7) and comprise muddy sediments corresponding to the EUNIS habitat A5.3 Sublittoral mud, which is dominated by the polychaete *N. diversicolor*, the amphipod *C. volutator*, the mollusc *M. balthica* and a variety of oligochaetes (Langston *et al.,* 2003).

10.4.172 Subtidal benthic biotopes, as mapped by the CCW HABMAP project (2010) (Figure 10.7), show that communities associated with the muddy sediments in the main channel of the River Ebbw are predominantly characterised by the sublittoral mud in variable salinity biotopes which grade into the *Capitella capitata* in enriched sublittoral muddy sediments biotope where the River Ebbw enters the River Usk.

10.4.173 As set out for intertidal mudflats above, the subtidal habitats of the River Usk are part of the River Usk (Lower Usk) SSSI. They are also within the River Usk SAC but are not one of the features for which the SAC is designated. They are thus valued at the National (High) level. The subtidal habitats of the River Ebbw are valued at the County (Medium) level.

Hedgerows

10.4.174 As shown on the habitat survey plan at Figure 10.4, hedgerows typically border the fields along the route of the new section of motorway (within the Gwent Levels section often adjacent to the reen or ditch forming the field boundary). Species-rich intact hedgerows, species-rich defunct hedgerows and species-rich hedgerows with trees were often recorded, many of which were categorised as Important Hedgerows under the Hedgerow Regulations 1995, as detailed in Appendix 10.21. Important hedgerows classified on the basis of ecological criteria only are shown on Figure 10.5.

10.4.175 Intact species-poor hedgerows, defunct species-poor hedgerows and species-poor hedgerows with trees were recorded throughout the survey area and typically comprised hawthorn, bramble or willow.

10.4.176 Hedgerows are a UK BAP/Section 42 habitat.

10.4.177 The Arup 2014 hedgerow survey report (at Appendix 10.5) explains that a total of 516 hedgerows were recorded during the survey and subsequently assessed for their importance. The majority of the hedgerows were categorised as 'unmanaged hedgerows' (a total of 213) with 72 of these hedgerows being assessed as important. A total of 127 hedgerows were recorded as 'intact managed hedgerows' (with 35 of these assessed as important) and 51 'managed gappy hedgerows', of which 11 were assessed as important. Five hedgerows were described as 'hedgebank with occasional shrubs' and no 'new/reinstated hedgerows' were recorded.

10.4.178 Important hedgerows were recorded in a number of areas along the route of the new section of motorway at Castleton, Berryhill Farm, south of Duffryn, east and south of Solutia, Pye Corner, Whitson substation, Bareland Street, Knollbury and Llanfihangel near Rogiet.

10.4.179 In 2015 forty eight hedgerows were surveyed between Castleton and Rogiet along the route of the proposed new section of motorway (Appendix 10.21). Hedgerows selected were those which had not previously been surveyed in the 2014 hedgerow survey (ES Appendix 10.5) and which would be affected by the proposed new section of motorway.

10.4.180 Thirty eight of the hedgerows were classified as 'important' in accordance with the Hedgerow Regulations criteria. The locations of these hedgerows are shown on Figure 10.5.

10.4.181 The Newport Local BAP includes a Farmland Habitat Action Plan, which includes hedgerows. The overall vision for the plan is to maintain, restore and extend farmland habitats in the county and the BAP species associated with them. The cultural importance of hedgerows and orchards also provides an opportunity to work with communities to look at the historical significance of these habitats within a community setting. The plan sets out the following objectives.

- To positively manage and protect farmland habitats in Newport and connect and expand the habitat where possible.
- To maintain and expand the range and/or population of species associated with these habitat types, through creation or expansion of farmland habitats.
- To identify and record priority areas of these farmland habitats within Newport.
- To raise awareness of the biodiversity, landscape and cultural importance of our farmland habitats and their appropriate management.

10.4.182 The Monmouthshire Local BAP includes a Boundary and Linear Features Habitat Action Plan. This includes hedgerows, the proposed targets for which are as follows.

- Maintain the extent of hedgerows across Monmouthshire.
- Maintain the overall number of individual, isolated hedgerow trees.
- Ensure that between 2005 and 2010 hedgerows remain, on average, at least as rich in native woody species (4 species).
- Achieve favourable condition of 35% of hedgerows by 2010 and 50% by 2015.
- Halt further decline in the condition of herbaceous hedgerow flora in Monmouthshire by 2010 (14 species).
- Improve the condition of the hedgerow tree population by increasing numbers of young trees (1-4 years).
- Achieve a net increase in the length of hedgerows.

10.4.183 The plan includes the following relevant actions.

- Ensure that boundary and linear features are not adversely affected by development.
- Ensure that boundary and linear features are fully considered when assessing any development, which may impact upon the habitat.
- When there is no alternative ensure that appropriate mitigation or compensation measures for boundary and linear features are implemented during development.
- Where appropriate, ensure opportunities for enhancing boundary and linear features are used during the planning process.

10.4.184 The Trunk Road Estate BAP includes a Habitat Action Plan for Boundary Features, which includes hedgerows. The objective of the action plan is to conserve and enhance boundary features of conservation value wherever possible. Specifically, to:

- ensure that impacts of new developments on boundary features, particularly those which are considered ‘ancient’ or ‘important’, are avoided where ever possible;
- mitigate against unavoidable impacts to boundary features;
- document the current distribution of boundary features within the soft estate so as to develop targeted management plans; and

- raise awareness of those involved in design, construction and maintenance processes of the ecological importance of boundary features of all types, and provide detailed advice to management contractors.

10.4.185 Given that the hedgerows within the corridor for the new section of motorway include species-rich hedgerows, a number of which are 'important' hedgerows in the context of the Hedgerow Regulations, they are valued at the County (Medium) level. However, it must be appreciated that within the Gwent Levels SSSIs, NRW regard hedgerows as detrimental to the important aquatic macrophytes and invertebrate communities as they can cause excessive shading and overgrowth of ditches.

Other Habitats

10.4.186 Other habitats that were mapped within the survey area and which are shown on the habitat survey plan at Figure 10.4 include arable fields, amenity grassland, ephemeral/short perennial habitat, spoil, waste tip, caravan sites, sea walls, buildings, bare ground and hard-standing or peripheral habitats including tall ruderal and non-ruderal vegetation.

10.4.187 The main areas of developed land are the Newport Docks area and the Solutia area industrial zones. These are dominated by hardstanding, buildings, bare ground, standing water, areas of scrub, invasive species and tall ruderal habitat. A detailed NVC/botanical survey was carried out of open areas within Newport Docks between the River Ebbw and the operational area of the port (described below).

10.4.188 The only operational landfill site within the survey area is the Newport Landfill Site and Household Waste Recycling Centre, located to the east of the River Ebbw. There are areas of spoil within the Tata Steelworks site, which have been colonised by scattered scrub, buddleia and tall ruderal species. Land within the Tata site was also subject to NVC/botanical survey (as described below).

10.4.189 There are areas of amenity grassland around residential areas such as Castleton, Marshfield, Magor and Rogiet and within the Parc Golf Course in Coedkernew. These take the form of gardens, managed road verges and urban parks. Many of these areas contain scattered planted trees.

10.4.190 Arable fields are largely located on the higher ground at the west and east of the survey area. In the west, arable land is located at Gwaunshonbrown Farm to the north of the existing M4, and at The Stud Farm and several nearby fields to the south of the A48. At the east of the survey area, there are arable fields present to the north west of Magor and to the north of Rogiet.

10.4.191 There is some arable land within the Gwent Levels (notably at Maerdy Farm south east of Coedkernew).

10.4.192 Brownfield sites included in the NVC survey were Great Pencarn – Duffryn, Solutia, Green Moor, Alexandra Dock and land at the south of the Tata Steelworks at Llanwern. Open mosaic habitats on previously developed land is a UK BAP/Section 42 habitat. The detailed survey data are set out in the reports at Appendices 10.4 and 10.20.

10.4.193 Vegetation regenerating on the brownfield land at several sites typically comprises a mosaic of grassland and scrub, but is difficult to place precisely

within the published NVC communities. Sparse vegetation on gravelly soils on these brownfield sites generally supports a diverse mix of annual species, usually grading into NVC MG1 grassland or scrub communities and often including notable species. Each of the brownfield sites surveyed supports locally notable annual species, for example Pencarn supports a distinctive community with common cudweed, small cudweed and wall bedstraw.

10.4.194 Brownfield land is often formed on man-modified substrata, such as concrete rubble at Solutia and steelworks slag at Tata Steel and Green Moor, and this can sometimes create conditions that favour unusual plant communities and locally notable species. An example of this within the surveyed sites is at Green Moor, where the low lying damp grassland bordered by slag supports hundreds of marsh orchid and pepper saxifrage plants and the locally notable narrow-leaved bird's-foot trefoil, and great lettuce is locally abundant on several of the track margins.

10.4.195 These diverse brownfield habitats qualify as the UK BAP/Section 42 priority habitat Open Mosaic Habitats on Previously Developed Land.

10.4.196 The study area at Alexandra Docks supports a varied mix of scrub, grassland and ruderal vegetation. The habitats of greatest nature conservation significance are the grassland areas and damp ground, especially in the more open and disturbed parts, and areas of former tipping. The more open parts qualify as the UK BAP/Section 42 priority habitat Open Mosaic Habitats on Previously Developed Land and several uncommon plants are present; most notably dittander, round-headed club-rush, dark mullein and great lettuce. The site is vulnerable to change because it is part of a working port and recent operational activities have resulted in several areas being cleared or built over. However, other parts have remained relatively undisturbed and are losing their botanical diversity due to becoming encroached upon by dense scrub.

10.4.197 The network of slag tracks, dry lagoon margins and occasional piles of tipped slag at the Tata steelworks support a sparse cover of diverse ruderal vegetation that would qualify as the UK BAP/Section 42 priority habitat Open Mosaic Habitats on Previously Developed Land. The slag provides an unusual substratum that supports a number of locally uncommon plants including white mullein, round-leaved wintergreen, round-leaved crane's-bill and large populations of great lettuce. The alkaline soils within the former settlement lagoons also have an unusual and rather sparse flora that is much less diverse than the slag but they include concentrations of locally notable species, including yellow-wort and narrow-leaved everlasting pea.

10.4.198 Several of the older lagoons at the steelworks land are in varying stages of succession. Several support a diverse, flower-rich mosaic of grassland, tall wetland herbs and scrub, which includes notable species including pepper saxifrage, brown sedge and narrow-leaved everlasting pea. These areas are significant for nature conservation in a county context. However, this is a transitional community and in the absence of management the habitat will eventually lose much of its value as it becomes dominated by dense scrub.

10.4.199 The Newport Local BAP includes a Brownfield and Urban Action Plan, which in turn includes open mosaic habitats on previously developed land. The overall vision for this plan is to maintain and enhance the wildlife value and potential of

brownfield habitats, gardens and other urban open spaces in Newport. The plan sets out the following objectives.

- To ensure there is the right amount of appropriate quality open space in the right places in Newport to provide for biodiversity and people's need to have contact with it (the accessible natural green space project).
- To maintain the extent of brownfield habitats in Newport that support BAP/Section 42 habitats and species.
- To secure appropriate management for biodiversity of significant areas of public open space/brownfield sites within the county.
- To raise awareness of brownfield sites and the benefits they bring us.
- To raise awareness of the benefits of wildlife friendly gardening and allotments, and ultimately to increase the number of wildlife-friendly features in gardens and allotments in the county.

10.4.200 The Monmouthshire Local BAP includes a Built Environment and Associated Green Spaces Habitat Action Plan, which in turn includes 'Wasteground', 'Brownfield' and Industrial Sites. The plan includes the following actions.

- Ensure wildlife associated with the built environment and the potential for built features to be used as habitat are fully considered when assessing development.
- When there is no alternative ensure that appropriate mitigation or compensation measures for affected wildlife are used during development.
- Ensure opportunities for enhancing the built environment for wildlife are used during the planning process.

10.4.201 Given the extent of the brownfield sites within the corridor for the new section of motorway, and the diverse invertebrate communities they support (see later in this section), they are valued at the County (Medium) level.

Species (Flora)

10.4.202 The desk study identified records of a total of 150 notable plant species within 2 km of the existing M4. One, bluebell, is protected from intentional picking, uprooting or destruction or being sold under the Wildlife and Countryside Act 1981 (as amended). Eight plants were listed under Section 42 of the NERC Act and/or are UK BAP species. The remaining plants were Red Data Book species, Local BAP species and locally important species. A number were listed on the IUCN threat listing of Welsh vascular plants.

10.4.203 A total of 160 plants was recorded within 2 km of the new section of motorway. Again, this included the partially protected bluebell. Eight species were listed under Section 42 of the NERC Act and/or UK BAP species. The remaining species were predominantly locally important species but also included a number of Red Data Book and Local BAP species.

10.4.204 Plant records were scattered across the search area with clusters of records in the south west of the search area on the Gwent Levels and at the eastern end of the search area at Magor Marsh and Slade Wood.

10.4.205 Bluebell was recorded in several locations, predominantly in areas to the north of the existing M4 motorway where woodland was more prevalent. Bluebell, slender bristle-moss, slender stubble-moss, handsome woollywort, ivy-leaved duckweed, rigid hornwort, sea-buckthorn, blunt-flowered rush, brown sedge, fen bedstraw, smooth brome, twiggy mullein, sea stork's-bill, basil thyme, wild mignonette, charlock, sea buckthorn, fragrant orchid and tubular water-dropwort were all recorded in close proximity to the existing M4 motorway. A number of records were recorded within or near to the new section of motorway.

10.4.206 Table 10.8 summarises the occurrence of notable species within the study area, using the list of Rare, Scarce and Declining species from the Guidelines for the Selection of Wildlife Sites in South Wales (South Wales Wildlife Trust Partnership, 2004) identified in the NVC botanical survey reports (Appendices 10.4 and 10.20). Tubular water dropwort is included in the list of species of principal importance for biodiversity in Wales (Section 42 of the NERC Act 2006). Sites supporting one or more of the guidelines' primary species or five or more contributory species can be considered significant in a county context.

10.4.207 The wildlife sites criteria also state that sites should be considered for selection if they support plant species listed as Nationally Scarce, Nationally Rare, Vulnerable, Endangered or Critically Endangered in the Red Data Book (Cheffing, C.M. & Farrell L. (Eds.), 2005) (Red Data Book species) or are included on the List of Species and Habitats of Principal Importance for the Conservation of Biological Diversity (Section 42). The Welsh Red Data Book for Vascular Plants (Dines, 2008) has re-evaluated the status of certain species in a Welsh Context.

Table 10.8: Summary of Primary and Contributory Species Observations

Species/Red Data Book Status	Common Name	Locations Recorded
PRIMARY SPECIES		
Alopecurus bulbosus (LC)	Bulbous Foxtail	Ebbw west seawall/saltmarsh
Catabrosa aquatic (LC)	Whorl-grass	Great Pencarn
Crepis biennis (LC)	Smooth Hawk's-beard	Great Pencarn
Filago vulgaris (NT/VU)*	Common Cudweed	Great Pencarn, Solutia
Galium parisiense (NS/VU)(NA)*	Wall Bedstraw	Great Pencarn, Ebbw east saltmarsh, Solutia
Hydrocharis morsus-ranae (VU)	Frog-bit	Whitecross Farm, Great Pencarn, Tata land
Lactuca virosa (LC)	Great Lettuce	Great Pencarn, Alexandra Dock, Tata land, Green Moor brownfield
Lepidium latifolium (NS/LC)	Dittander	Ebbw east saltmarsh, Alexandra Dock, Usk east saltmarsh
Oenanthe aquatica (LC)	Fine-leaved Water-dropwort	Solutia
Oenanthe fistulosa (VU/S42)	Tubular Water-dropwort	New Dairy Farm, Whitecross Farm, Tatton Farm, Green Moor brownfield, Green Moor fields
Oenanthe pimpinelloides (LC/CR)*	Corky-fruited Water-dropwort	Broad Street Common
Ranunculus lingua (LC)	Greater Spearwort	Pwll Diwaelod

Species/Red Data Book Status	Common Name	Locations Recorded
Sagittaria sagittifolia (LC/VU)*	Arrowhead	Great Pencarn, Whitecross Farm, Tata land, Green Moor fields
Scirpoides holoschoenus (NR/EN) (NA)*	Round-headed Clubrush	Alexandra Dock
Thalictrum flavum (LC)	Common Meadow-rue	Greenmoor Lane
Verbascum lychnitis (NS/LC) (NA*)	White Mullein	Tata land
Verbascum nigrum (LC/NT)*	Dark Mullein	Alexandra Dock
CONTRIBUTORY SPECIES		
Anacamptis pyramidalis (LC)	Pyramidal Orchid	Alexandra Dock
Apium graveolens (LC)	Wild Celery	Ebbw west seawall/saltmarsh, Ebbw east saltmarsh
Ballota nigra (LC)	Black Horehound	Alexandra Dock
Blackstonia perfoliata (LC)	Yellow Wort	Pound Hill, Great Pencarn, Alexandra Dock, Solutia, Tata land
Bromus racemosus (LC)	Smooth Brome	Lighthouse Road, Whitecross Farm, Solutia, Broad Street Common, Tatton Farm, Green Moor fields
Bryonia dioica (LC)	White Bryony	Roggiett Brake and Rectory Woods
Carex disticha (LC)	Brown Sedge	Solutia, Tata land, Green Moor brownfield, Greenmoor Lane
Carex pseudocyperus (LC/NT)*	Cyperus Sedge	Pye Corner, Tatton Farm
Carex strigosa (LC)	Thin-spiked Wood-sedge	Pwll Diwaelod, Berryhill Farm woodland
Daphne laureola (LC)	Spurge Laurel	Roggiett Brake and Rectory Woods
Echium vulgare (LC)	Viper's bugloss	Alexandra Dock
Euphorbia amygdaloides (LC)	Wood Spurge	Roggiett Brake and Rectory Woods
Filago minima (LC)	Small Cudweed	Great Pencarn
Geranium rotundifolium (LC)	Round-leaved Crane's-bill	Alexandra Dock, Tata land
Glaucium flavum (LC)	Yellow-horned Poppy	Alexandra Dock
Hordeum secalinum (LC)	Meadow Barley	Whitecross Farm, Ebbw east saltmarsh, Solutia, Broad Street Common, Tatton Farm, Green Moor brownfield, Green Moor fields, Tata land
Iris foetidissima (LC)	Stinking Iris	Roggiett Brake and Rectory Woods
Lathyrus nissolia (LC)	Grass Vetchling	Pwll Diwealod, Pound Hill, Great Pencarn, Alexandra Dock, Solutia, Broad Street Common
Lathyrus sylvestris (LC)	Meadow vetchling	Great Pencarn, Alexandra Dock, Solutia, Broad Street Common, Tata land, Green Moor brownfield,
Lemna trisulca (LC)	Ivy-leaved Duckweed	Great Pencarn, Fox Covert

Species/Red Data Book Status	Common Name	Locations Recorded
Lotus glaber (LC)	Narrow-leaved Bird's-foot Trefoil	Alexandra Dock, Green Moor brownfield
Medicago arabica (LC)	Spotted Medick	Broad Street Common
Oenanthe lachenalii (LC)	Parsley Water-dropwort	Ebbw east saltmarsh
Ophrys apifera (LC)	Bee Orchid	Great Pencarn
Parapholis strigosa (LC)	Hard-grass	Ebbw east saltmarsh
Picris hieracioides (LC)	Hawkweed Oxtongue	Alexandra Dock
Potamogeton pusillus (LC)	Lesser Pondweed	Great Pencarn
Pyrola rotundifolia (LC)	Round-leaved Wintergreen	Tata land
Ranunculus auricomus (LC)	Goldilocks Buttercup	Roggiett Brake and Rectory Woods
Rumex hydrolapathum (LC)	Water-dock	Greenmoor Lane
Silaum silaus (LC)	Pepper Saxifrage	Solutia, Tata land, Green Moor brownfield
Sison amomum (LC)	Stone Parsley	Pound Hill, Great Pencarn, Alexandra Dock, Usk east saltmarsh, Pye Corner, Broad Street Common, Tatton Farm, Tata land
Spergularia media (LC)	Greater Sea-spurrey	Ebbw west saltmarsh/seawall, Ebbw east saltmarsh
Spirodela polyrhiza (LC)	Greater Duckweed	Great Pencarn
Ulmus minor (LC)	Small-leaved Elm	Magor Road
Valerianella carinata (LC)	Keeled-fruited Corn-salad	Solutia
Viburnum lantana (LC)	Wayfaring Tree	Roggiett Brake and Rectory Woods
Viscum album (LC)	Mistletoe	Tatton Farm, Tata land, Green Moor brownfield, Green Moor fields

Status abbreviations: Least Concern (LC), Nationally Scarce (NS), Near Threatened (NT), Nationally Rare (NR), Vulnerable (VU), Endangered (EN) or Critically Endangered (CR) in the Red Data Book. Where different, from the GB RDB, the status in the Welsh RDB is shown and marked with an asterisk. (NA = Not applicable to Welsh RDB, because not native in Wales)

10.4.208 The notable species listed above include a high proportion of plants characteristic of wet grassland habitats. The assemblage of wet grassland plants is assessed overall as being of County (Medium) value.

10.4.209 Additional notable plant species recorded during the aquatic macrophyte survey (see Table 10.7 above) were as follows.

Alisma lanceolatum	Primary
Butomus umbellatus	Primary
Ceratophyllum demersum	Contributory
Lemna gibba	Contributory
Potamogeton trichoides	Primary
Veronica catenata	Contributory

Wolffia arrhiza	Primary
Zannichellia palustris	Contributory

10.4.210 For the purposes of assessment, the aquatic macrophyte community of the watercourses as a whole is considered to be of National (High) value.

10.4.211 Other individual species of interest are associated with woodlands and with the vegetation of industrial sites and are covered by the value of these habitats set out earlier in this section.

Species (Fauna)

10.4.212 Information on the faunal species within and in the vicinity of the new section of motorway has been gathered through desk study and ecology surveys carried out by or on behalf of Arup in 2014 and RPS in 2015. Hyder also carried out a wintering bird survey over the winter of 2015/2016. The reports of these surveys form Appendices 10.2 to 10.33 of this ES.

10.4.213 Detailed accounts are provided below of those species for which surveys were considered necessary in order to inform the EIA. Other species recorded in the desk study included brown hare (UK BAP, Section 42), harvest mouse (UK BAP, Section 42), polecat (UK BAP, Section 42, Red Data Book, Newport BAP), fallow deer (Newport BAP), stoat (Newport BAP), weasel (Newport BAP), water shrew (Newport BAP), common shrew (Newport BAP) and common porpoise (European Protected Species, Wildlife and Countryside Act (WCA), UK BAP, Section 42, Red Data Book).

10.4.214 Common porpoise was recorded once along the River Usk and once at Newport Wetlands Reserve.

10.4.215 Polecat was recorded at three locations at the western end and centre/east of the search area along the route of the existing M4 motorway. Records included roadkill along the existing M4 motorway.

10.4.216 Brown hare and harvest mouse were recorded at the eastern end of the search areas and frequently at Newport Wetlands Reserve and both were recorded at Magor Marsh.

10.4.217 Stoat was recorded at the eastern end of the study area and once at the western end on the edge of St. Mellons, at Newport Wetlands Reserve in the centre of the search area and at the eastern end of the search area at Magor Marsh. Weasel was recorded at Magor Marsh, Newport Wetlands Reserve and the Gwent Levels.

10.4.218 Common shrew was recorded in one location at the western end of the search area west of Newport and water shrew was recorded in two locations south of Magor.

10.4.219 Fallow deer was recorded in the centre of the search area very close to the existing M4 motorway.

Otter

10.4.220 Desk study records of otter were identified from across the 2 km study area and predominantly along waterbodies, including the River Rhymney, River Ebbw,

River Usk, Monmouthshire and Brecon Canal and along reens in the Gwent Levels. There was a concentration of records in the south east of the survey area at Magor Marsh and along the Monmouthshire and Brecon Canal to the west of the River Usk. A number of road fatalities were also recorded, including otter fatalities along the existing M4 motorway. Otter was recorded in several locations along reens near to the proposed new section of motorway.

10.4.221 The key findings of the 2014 and 2015 otter surveys are shown on Figure 10.8. The Arup survey in 2014 found otter field signs across the study area (Appendix 10.8). No field signs were found in the Castleton area. However, in an area nearby at Coedkernew which experiences little human disturbance, presence of otter was identified. It appears that the otters use the main reen network, for example Percoed Reen, due to the high water quality and connectivity to other favourable habitat. Spraint was found on a reen adjacent to the River Ebbw. Slides and footprints were seen on waterbodies adjacent to the River Usk SAC, for which otters are a feature. A slide was also found heading into a field ditch near Pye Corner. Otter presence was identified in the area of Llanwern Steelworks and field signs were also found on Mill Reen in the eastern part of the study area. No otter holts or hovers were found.

10.4.222 It was concluded that otters are finding a niche amongst the industry, housing and farming within the study area, utilising suitable habitat that has good water quality, prey availability and that provides cover.

10.4.223 No otter field signs were found during the surveys of 58 waterbodies within the narrower 2015 survey area despite there being an abundance of suitable habitat (Appendix 10.25). A recent otter spraint was identified during a visit to land to the south east of the Tata Steel landholding, outside the 2015 survey area.

10.4.224 The majority of the reens, main rivers and field ditches that were surveyed were within the Gwent Levels SSSIs. The regular management of many of these watercourses provides an abundance of good otter habitat throughout these parts of the route of the new section of motorway.

10.4.225 In 2014 the Arup otter survey covered a total of 1,442 waterbodies and identified otter signs at a total of 18 waterbodies surveyed, which equates to 1 in every 80 watercourses. The low number of waterbodies at which evidence of otter activity was found indicates that although otter are present along the length of the proposed new section of motorway, they are widely dispersed. Although no signs of otters were found during the 2015 survey (other than a single spraint found incidentally near to the survey area), the findings of the 2015 survey confirmed the continuing suitability of the habitat within the Gwent Levels part of the new section of motorway for otter and for the purpose of this ES it is assumed that otter are present at low density throughout the Gwent Levels part of the new section of motorway.

10.4.226 Otters were considered widespread throughout the UK up until the 1950s when they underwent a rapid decline through to the 1970s. This was considered to have largely been the result of the use of organochlorine pesticides, exacerbated by hunting and habitat fragmentation. There has since been a significant recovery in the number and range of otters in England and Wales. Locally, otter numbers are increasing and populations are known to be present on all the rivers in Newport - the Usk, Ebbw and Rhymney as well as in the reens of the Gwent

Levels SSSIs and the Monmouthshire-Brecon Canal (Newport Biodiversity Partnership, 2015).

10.4.227 Otter is included in the Newport Local BAP. The species action plan includes the following objectives.

- Undertake action, including riparian habitat management and creation of otter bridges/shelves where safe bank side access is not available, in order to help increase the population and range of otters.
- To gather data on the distribution and status of otters in Newport.
- To raise awareness of the importance of otters in Newport and provide advice on habitat management.
- To ensure that surveys are undertaken to inform decision making/planning of any plan or project that has the potential to affect otters.

10.4.228 The Trunk Road Estate BAP includes a species action plan for Otter. The objectives of this are to:

- avoid impacts of new road schemes or improvements on otters;
- mitigate unavoidable impacts on otters and/or their habitats;
- reduce the level of incidental otter mortality on existing roads;
- safeguard and enhance known otter populations close to the road network;
- raise the awareness of Transport Directorate staff, Trunk Road Agents and consultants regarding the significance of otters on the network;
- safeguard and enhance potentially suitable habitat features for otters within the soft estate; and
- to develop a greater knowledge of the distribution of otters across the trunk road network.

10.4.229 The following relevant actions are included in the plan.

- Where impacts of new schemes and road improvements on otter habitat are unavoidable, consider the options for wide-span bridges, otter ledges, road underpasses, otter resting places, other habitat improvements, and artificial holts, and prevent effects on feeding areas through appropriate pollution controls.
- Increase the amount of available otter habitat by removing barriers to dispersal (for example, under bridges and through culverts) and by creating suitable habitat wherever possible.

10.4.230 Otter is a designated feature of the River Usk SAC and is found along most of the length of the river and its tributaries upstream of Newport. The Natura 2000 Standard Data Form for the SAC estimates the resident otter population in the River Usk SAC to be between 11 and 50. JNCC estimated the UK otter population to be at least 10,395. Thus the River Usk population represents up to some 0.5% of the total UK population. To the extent that otters will move up and down the Usk through Newport, the SAC population will interact to a degree with the otters found across the Gwent Levels. Otter is not a feature for which the Gwent Levels SSSIs are notified. However, given the potential for interaction between the otters in the Gwent Levels and River Usk, the otter population in the

vicinity of the proposed new section of motorway is considered to be of National (High) value.

Dormouse

10.4.231 The desk study identified hazel dormouse records at the western end of the 2 km search area north of St Mellons and in two areas of woodland at the north east end of the search area at Slade Wood and in woodland at St. Bride's, Netherwent. Further records in the west were from Cefn Mably Woods, Ruperra Woodlands and Park Wood. One record was provided within 1 km of the existing M4 motorway in the centre/east of the search area beside the A449 road.

10.4.232 The records of dormouse presence in the 2014 and 2015 dormouse surveys are shown on Figure 10.8. The Arup 2014 survey confirmed dormouse presence within woodland and hedgerow habitat and within existing motorway verges in the western part of the study area (Appendix 10.9). Habitat connectivity between the areas where dormice were identified and the presence of the known historic populations to the west provide the most likely explanation for this.

10.4.233 No evidence of dormouse presence was found within the central and eastern parts of the study area. Although dormice may successfully cross roads and disperse more widely from natal sites, the general lack of suitable habitat linkages between areas of habitat is the likely explanation for the lack of dormouse activity at Berryhill Farm and the Church Lane woodland. This was also considered likely to be the case within the Gwent Levels where suitable habitat (such as large woodland blocks) is absent or fragmented and there is an absence of ground habitat for hibernation.

10.4.234 In the Magor area, the lack of habitat linkages between potentially suitable habitats was considered to be the probable reason for their absence.

10.4.235 In the 2015 RPS survey, dormice continued to be recorded in the Arup survey sites within the New Park Farm and Castleton areas at the west of the survey area. A single dormouse nest was recorded within the hedgerow south of Tata Steelworks where no evidence of dormouse had previously been recorded. Following this further dormouse tubes were installed in suitable connected habitat in this area, and also at Pye Corner. No dormice were recorded in these new survey areas at either Tata Steelworks or at Pye Corner.

10.4.236 No evidence of dormice was recorded within the Arup tubes in the Magor area. However within the extended 2015 survey areas a small collection of seed heads of old man's beard was found within a tube within the proposed Ifton Quarry Haul Road survey area. This was considered to be possible evidence of dormouse, but could not be confirmed as it was not a typical dormouse nest and no other dormouse evidence was found in this area.

10.4.237 Dormouse presence was recorded in all the other 2015 new survey areas. These areas are both north and south of the existing M4 motorway between Junctions 28 and 29 at the western end of the survey area and north of the M4 east of Junction 23A at the eastern end of the survey area.

10.4.238 Dormouse nests and live dormice were frequently recorded at the western end of the survey area throughout the survey period, whereas dormouse nests were only been recorded between September and November at the eastern end and only two confirmed nests were recorded within this area.

10.4.239 The dormouse is a European protected species whose numbers and distribution have declined over the past 100 years. It has become extinct in around half its former range. In Wales, dormice occur in a few widely separated areas in every county except Anglesey (Bright, P. *et al*., 2006). The river valley of the Usk, with its associated woodlands and species-rich hedgerows, is an important area of Newport for dormice. They have also been recorded along the existing M4 and A449 corridor, as well as around Wentwood in the north eastern part of the county, and also in the far west of the county in Park Wood close to the Caerphilly boundary (Newport Biodiversity Partnership, 2014). Dormouse is included in the Newport Biodiversity Action Plan and the objectives of the species action plan are as follows.

- To maintain and increase the population of dormice in Newport through positive habitat management.
- To gather data on the distribution and status of dormice in Newport.
- To raise awareness of the importance of dormice in Newport and provide advice on habitat management to landowners.
- To ensure that surveys are undertaken to inform decision making/planning of any project that has the potential to affect dormice.

10.4.240 The Trunk Road Estate BAP includes a species action plan for dormouse which includes the following objectives:

- consider, and where possible avoid, any adverse impacts of road construction on dormice;
- following comprehensive assessment, mitigate against those impacts that are unavoidable;
- promote the profile of the dormouse populations within Wales to contractors, consultants, Trunk Road Agents and the Transport Directorate Staff;
- continue to enhance the knowledge of dormouse distribution within Wales, particularly within the soft estate; and
- should dormouse populations be identified as using the soft estate, maintain and, where possible, enhance the habitat to retain the species.

10.4.241 The plan includes the following relevant actions.

- Include dormice at the earliest stages of road design, construction and maintenance, in order to ensure the early identification of dormice-related issues.
- Where impacts are unavoidable, make efforts to create alternative habitats and enhance remaining habitat. Consider the provision of ‘links’ (such as rope bridges) across roads to prevent them acting as barriers to dispersal.
- Promote soft estate management techniques that enhance potentially suitable dormouse habitat. Extend current planting schemes to provide habitats of value to dormice.

10.4.242 There is an apparently strong population of dormouse in the area of the Castleton Interchange which is associated with the extensive mature tree planting around the existing junction, and there are additional occurrences of the species at the south of the Tata Steelworks and to the north of Magor. Recognising the

protected status of dormouse and its inclusion in the Newport Local BAP, the population of dormouse in the area of the M4 is considered to be of County (Medium) value.

Bats

10.4.243 The desk study identified records of a total of 13 bat species within 5 km of the existing M4 motorway. These included the following.

- Daubenton's bat.
- Whiskered bat.
- Brandt's bat.
- Natterer's bat.
- Serotine.
- Lesser noctule or Leisler's bat.
- Noctule bat.
- Nathusius's pipistrelle.
- Common pipistrelle.
- Soprano pipistrelle.
- Brown long-eared bat.
- Greater horseshoe bat.
- Lesser horseshoe bat.

10.4.244 The same species were recorded within 5 km of the proposed new section of motorway, with the exception of Brandt's bat.

10.4.245 There were also records of unidentified Myotis bats, pipistrelle bats, long-eared bats and undifferentiated whiskered/Brandt's bats.

10.4.246 Bats were recorded widely across the search areas 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.

10.4.247 Records of Serotine, common pipistrelle, soprano pipistrelle, unidentified pipistrelle, noctule, unidentified Myotis bat, whiskered/brandt's were recorded along or very close to the route of the existing M4 motorway.

10.4.248 Common pipistrelle and noctule were recorded on the edge of the route of the new section of motorway near to the River Usk at Newport Docks. Common pipistrelle, noctule, soprano pipistrelle and unidentified bats were recorded near to the proposed new section of motorway around Magor.

10.4.249 Common pipistrelle was the most frequently recorded species and was recorded across the search area.

10.4.250 Locations of bat roosts and of high bat activity recorded in the 2014 and 2015 surveys are shown on Figure 10.8. The surveys undertaken by Arup for bats

during 2014 identified trees and other features which have the potential to support bats (Appendix 10.7).

10.4.251 In 2015 a preliminary assessment of buildings and trees was carried out over the period July – August. Dusk emergence/dawn swarming surveys were undertaken on all buildings and trees which were considered to have bat roost potential between August and early October 2015.

10.4.252 Several buildings within or close to the proposed new section of motorway were identified as having bat roost potential. Further survey work was undertaken on these buildings to determine whether they were being used as a bat roost.

10.4.253 The following buildings which were surveyed have been identified as bat roosts.

- Old Stores in Newport Docks.
- Pye Corner Farm.
- Tatton Farm.
- The Vicarage, Magor.

10.4.254 Only a small number of common pipistrelles were recorded emerging from the buildings. No roosts of other species have been recorded.

10.4.255 Of the trees with high roost potential surveyed, three have been identified as bat roosts and two trees identified as probable roosts. A brown long eared bat and three common pipistrelles were seen emerging from tree T80. Bats were also seen emerging from T274 and T375, but with no audible call. These trees were confirmed as bat roosts.

10.4.256 A high level of bat activity was recorded around the canopy of trees T39 and T45 but no bats were seen to emerge from or return to roost in these trees; trees T39 and T45 were therefore identified as probable bat roosts.

10.4.257 During the 2014 Arup bat activity surveys a total of nine individual bat species was recorded, along with long-eared bat species and *Myotis* bats likely to include whiskered bat, Brandt's bat, Natterer's bat and Daubenton's bat, bringing the total to 14 out of the 17 species known to breed within the UK.

10.4.258 Woodland areas, grazed grasslands and areas comprising tree lined lanes and watercourses were found to have the highest levels of bat activity within the study area.

10.4.259 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.

10.4.260 A greater horseshoe bat was recorded on a single occasion. This location is approximately 8.5 km from Ruperra Castle SSSI, which is the nearest known roost. There is the potential that this bat was either foraging in the area or was moving between summer and winter roosts.

10.4.261 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.

10.4.262 A total of 104,575 bat passes was recorded during the course of the static detector surveys. The maximum levels of bat activity were recorded during the first survey visit (carried out between 04 June and 22 July 2015).

10.4.263 The highest levels of bat activity recorded during individual survey visits were from Locations 43, 13 and 27, respectively. Locations 43 and 27 are both situated near the western end of the new section of motorway, both to the south of Duffryn. Location 13 was near Tatton Farm, to the east of Pye Corner. The majority of bat passes recorded in these areas were made by pipistrelles and other relatively common species.

10.4.264 The diversity of bat species recorded was consistently higher at the eastern end of the proposed new section of motorway around Llandevenny and Magor than the western end.

10.4.265 Lesser horseshoe bats were only recorded in the areas around Magor and Llandevenny in 2015. Activity levels for this species were highest during survey visit 1, with the levels observed in visits 2 and 3 being broadly similar (22 and 38 passes, respectively). The levels of lesser horseshoe bat activity in this area are generally comparable with those observed in 2014.

10.4.266 The underpass and bridge surveys undertaken demonstrate that the St Bride's Brook 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. Species recorded were common and soprano pipistrelles and Myotis species commuting both north and south through the underpasses throughout the dusk and dawn surveys.

10.4.267 Only a small number of common pipistrelles were recorded commuting through the B4245 underpass during the dusk survey. No bats were recorded commuting over the M4 motorway bridges at Pound Hill at Castleton and or Grange Road at Magor.

10.4.268 There is a species action plan for bats in the Newport Local BAP, the objectives of which are as follows.

- To maintain and enhance the population of all bat species in Newport through appropriate habitat management and creation. For pipistrelle species, this involves the creation and protection of riparian habitats and associated water quality; for brown long-eared bats and noctules, woodland, parkland and amenity trees and hedgerows are more important; and for lesser horseshoe bats, they need a network of habitats to provide connectivity between roosts, surrounding habitat and foraging areas.
- To gather data on the distribution and status of bat species in Newport through national and local survey projects.
- To raise awareness of the importance of bats in Newport and provide advice on habitat/roost management and protected status.

- To ensure that surveys are undertaken to inform the decision making/planning of any application/project that has the potential to affect bats.

10.4.269 The Trunk Road Estate BAP includes a species action plan for bats, the objectives of which are to:

- undertake maintenance operations at the most appropriate time of year, after relevant surveys have been completed;
- avoid the loss of roosts, foraging areas and linear corridors during road construction and widening schemes;
- identify opportunities for enhancement of habitats for bats during design, construction and maintenance;
- avoid road mortality to bats.

10.4.270 The plan includes the following relevant actions.

- Include bats at the earliest stages of road design, construction and maintenance in order to ensure the early identification (and appropriate management) of sites valuable as roosts, foraging areas, and linear corridors.
- Avoid the indirect impacts of water-based pollution on valuable feeding areas by using and maintaining appropriate road runoff control and treatment measures.
- Consider options for mitigation and enhancement in all road construction and maintenance operations (e.g. bat tunnels, habitat enhancements and hibernacula).
- Increase opportunities for roosting bats in areas of woodland within the highway boundary (which are otherwise suitable for use by foraging bats) by adding artificial roosts.

10.4.271 Wray *et al.* (2010) developed a method for the evaluation of bats in environmental assessment, which considers various factors: the rarity of the bat species recorded; number of bat passes recorded during any one survey visit; number of (potential) bat roosts within the proximity; complexity of the surrounding habitat network; and the types and potential value of habitat in the surrounding area to foraging bats. This methodology has been taken into account for the assessment of the value of the proposed new section of motorway for bats.

10.4.272 Recognising that all bats are European Protected Species and taking the results of the 2014 and 2015 reports together, based on the methodology of Wray *et al.* (2010), the corridor of the proposed new section of motorway 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).

Water Vole

10.4.273 Desk study water vole records were associated with waterbodies in the 2 km search area and the majority were located in the south east within the Gwent

Levels and particularly around Magor Marsh. Individual records were also located along the River Usk north of the existing M4 and at the western end of the search area in a pond. There were three records close to or on the route of the new section of motorway. Individual records were also provided at Newport Wetlands Reserve.

10.4.274 The locations of watercourses where water vole activity was recorded in the 2014 and 2015 surveys are shown on Figure 10.8. The Arup 2014 survey identified water vole field signs on 126 of the 1,442 waterbodies across the survey area (Appendix 10.8). These were mainly on waterbodies such as reens that are managed as part of the Gwent Levels ditch system. The current management regime allows for a mosaic of habitats suitable for use by for water voles, with areas of open water, good water quality, banks for burrowing, marginal vegetation, vegetative cover from predators and emergent vegetation for foraging.

10.4.275 Through habitat suitability mapping, both high and medium potential habitat was identified; the majority of these waterbodies were interconnected with other suitable habitat allowing corridors for water voles to disperse. At the time of survey, water voles had recently been released at Magor Marsh and could be using the interconnecting waterbodies within the study area to disperse across the Gwent Levels. Water vole field signs were found adjacent to waterbodies with low potential in the Tata steelworks land, utilising marginal habitat.

10.4.276 Water vole field signs were found in 19 of the 58 waterbodies surveyed during the 2015 surveys. The waterbodies where water vole field signs were found were restricted to either field ditches or reens. These waterbodies typically have still or slow flow of water, vegetated banks and are often well managed.

10.4.277 Positive signs of water vole were mainly within the reen and field ditch network south of Llandevenny, with the only other area of water vole activity being approximately 50 m to the east of Tatton Farm within a small field ditch adjacent to Julian's Reen.

10.4.278 An extensive water vole population was identified within watercourses to the south of Llandevenny. Water voles have been released in this area by the Gwent Wildlife Trust during 2012 and 2015 as part of a re-introduction programme based on their Magor Marsh Nature Reserve to the east. Evidence of water voles was found within the majority of suitable watercourses in this area and the water voles within the new section of motorway corridor here are likely to be part of a much larger population within the surrounding landscape. As the habitat quality is optimal in this area it is likely that any territories are relatively small. Therefore, it is likely that a large number of territories are present in this area.

10.4.279 Arup recorded some water vole activity in the area of Coedkernew in 2014 with latrines, feeding stations and pathways being found in four waterbodies. During the 2015 survey, waterbodies directly south of this area were covered and no evidence of water vole activity was found so it is likely that the water vole population in this area is confined to a relatively small area.

10.4.280 To the south and east of Tatton Farm, in 2014, Arup recorded water vole activity in two waterbodies which were located to the east and south of the 2015 study area. No field signs were found in the 2015 survey area but, as referred to above, water vole activity was recorded approximately 50 m east of Tatton Farm.

Of the waterbodies located within the 2015 study area, only two were deemed suitable for water vole.

10.4.281 The water vole was once common but has suffered a catastrophic decline, chiefly through habitat loss and degradation and predation by the introduced American mink. Water vole is protected under the Wildlife and Countryside Act 1981 and is a UK BAP/Section 42 priority species. The Newport Local BAP states that there is limited knowledge of Newport's water vole population, and refers to evidence of water vole on the Gwent Levels around Nash and Goldcliff and the Monmouthshire and Brecon Canal. The Gwent Wildlife Trust's successful water vole reintroduction programme at Magor Marsh Nature Reserve is also referred to with the view that this may encourage individuals to expand out of the reserve into the wider Gwent Levels.

10.4.282 The Newport Local BAP states that a major objective for water voles is to enhance and create suitable habitat to re-establish links within its range along the coastal floodplains and restore water vole populations to these areas. Specific objectives are as follows.

- To maintain and increase the range and population of water voles in Newport.
- To gather data on the distribution and status of water voles in Newport.
- To raise awareness of the importance of water voles in Newport and provide advice on habitat management.
- To ensure that water vole conservation issues are recognised and incorporated in all relevant plans and policies that affect the coastal floodplain area and other potential water vole habitat.

10.4.283 The Trunk Road Estate BAP includes a species action plan for water vole, which has the following objectives:

- avoid and reduce all impacts of new road construction or road improvement on water voles unless absolutely necessary;
- improve the quality of surrounding habitat and create new habitats where impacts are unavoidable;
- enhance the habitat in the soft estate where populations of water voles are known to occur on or near new or existing road schemes, and enhance areas potentially suitable for, but not yet occupied by, water voles;
- raise awareness of those involved in planning, construction and maintenance of the network to the significance and fragility of water vole populations; and
- improve the knowledge of the distribution of water voles and the importance of habitat within the soft estate.

10.4.284 The plan includes the following relevant actions.

- For all road construction and road improvement schemes, include an initial desk study and water vole survey as identification within the scoping stage of the development may allow impacts to be avoided.
- Offset unavoidable impacts from road development by the provision of new habitats, improvement of existing habitats, positive management actions (for example, provision of fencing, scrub control) and the control of pollution from road runoff.

- Remove the barriers to dispersal of water voles through the provision of purpose designed drains and water features.

10.4.285 Recognising that water vole is a protected species and that the population in the Gwent Levels is robust and increasing as a result of the work of the Gwent Wildlife Trust, the population in the area of the new section of motorway is considered to be of County (Medium) value.

Badger

10.4.286 Desk study records of the locations of badger setts and badger activity are considered sensitive and therefore any records of badger setts are provided in a confidential appendix to the desk study. Those with a legitimate need for the information may request it.

10.4.287 The Arup 2014 survey identified 20 setts, which were considered likely to present 13 family groups of badgers within the study area (Confidential Appendix 10.37).

10.4.288 Six new setts were identified during the 2015 survey. These include two active main setts and four outliers (one active and three disused) (Confidential Appendix 10.38).

10.4.289 The survey information for the 2014 and 2015 surveys may be summarised as follows.

Castleton Interchange

10.4.290 Two active main setts have been identified within this area. One main sett was active in 2015 and in the same condition as previously recorded during the 2014 survey. During the 2015 survey several well used pathways between entrances were noted as well as the presence of badger hair in one entrance.

10.4.291 Partially used and active outlier setts previously recorded during the 2014 survey have been reclassified as an active main sett, with two associated annexes on the basis of the 2015 survey. The main sett consists of at least eight holes and the two annexes consist of five and three holes respectively. There is evidence of fresh soil and footprints at several of the entrances.

10.4.292 Two outliers have also been recorded within the area. These comprised an active outlier thought to be connected to the second main sett and a disused outlier within the existing M4 road verge thought to be connected to the other main sett.

10.4.293 A disused outlier recorded during the 2014 survey was not reviewed as it is not likely to be affected by the proposed new section of motorway.

10.4.294 Other signs of badger activity recorded in this area during the 2015 survey included further latrines and crossing points/push-throughs at Michaelston-y-Fedw Farm.

Gwaunshonbrown Farm and Cefn Llogell

10.4.295 Access into this area was restricted during the 2014 badger survey. A main sett with five entrances was recorded during the 2015 survey. In addition to this, several latrines and crossing points/push-throughs were recorded within the areas to the north east and west of this sett.

10.4.296 The presence of latrines along the existing northern M4 motorway verge and the fields south of Gwaunshonbrown Farm may indicate the interface between this sett and the first referred to under Castleton Interchange above.

Coedkernew

10.4.297 A large number of latrines was recorded within Parc Golf Course during the 2014 survey. Badger pathways and a sample of hair were recorded near the old Garden Centre at Castleton and a badger was also recorded on a camera trap within Berryhill Farm.

10.4.298 Little further evidence of badger was recorded in this area during the 2015 survey, other than a few crossing points/push-throughs near to Berryhill Farm, Pound Hill and near the roundabout to the south west of Imperial Park.

10.4.299 No badger setts have been recorded in this area.

Wentlooge Levels

10.4.300 Relatively little sign of badger activity was recorded within this area during the 2014 survey. A number of pathways were recorded but none were found with definitive evidence of badgers. Some of the pathways were considered to be made by foxes. Opportunities for setts within this area are limited to the embankments of bridges over the railway line, both of which had been replaced in the last two years. It was therefore considered unlikely that badgers would be present within this area.

10.4.301 Three potential badger crossing points/push-throughs were recorded in this area during the 2015 badger survey. No other signs of badger were recorded.

Pye Corner

10.4.302 Two setts were recorded within this area during the 2014 badger survey. A disused outlier (Q) and a disused annex (R) were recorded within the old laboratory site at Pye Corner. Latrines and pathways were recorded within the area.

10.4.303 Latrines were also recorded near Tatton Farm in 2014. Additional push-throughs/ crossing points were recorded within fields south of Tatton Farm in 2015.

Tata Steelworks

10.4.304 Two main setts were recorded within the Tata Steelworks land during the 2014 badger survey. An annex sett was recorded just east of one of the main setts. No other signs of badger were recorded within this area. Pathways within this area were considered to be made by fox or otter.

10.4.305 One of the main setts was located during the 2015 survey but no recent evidence of use was identified. Three entrances were found which were full of debris and appeared unused. A possible badger pathway was identified just west of this sett.

10.4.306 The locations of the other main sett and annex were not identified within the dense scrub and reedbed. It is assumed that these setts are still present and active and further pre-construction survey work would be required to determine their exact location.

10.4.307 Further latrines were recorded during the 2015 survey in fields south of Tata and the main sett and also within the surrounding reedbeds.

Llandevenny

10.4.308 One active sett was recorded in this area during the 2014 badger survey. A sett was identified during the construction of the A4810 and classified as an annex sett. It is thought that the associated main sett is located within the railway cutting that could not be accessed. The annex had at least six entrances and showed signs of significant use.

10.4.309 Further survey work was carried out within this area during the 2015 survey. Crossing points/push-throughs and a latrine were recorded along the A4810.

10.4.310 A dead badger was recorded on the A4810 in September 2015.

Magor to Rogiet

10.4.311 Four setts were identified within this area to the north of the existing M4 during the 2014 badger survey. These were an active outlier within woodland, a main sett with an associated partially used outlier and a large active main sett.

10.4.312 These areas were not resurveyed during 2015, other than the area including the large main sett, as they are not likely to be affected by the proposed new section of motorway. The large main sett showed no signs of recent use. At least 20 entrances were recorded within the field edge and hedgerow. However, many of these had collapsed, become overgrown or had been filled with debris showing no signs of recent use. There was some evidence that some of the holes were now occupied by rabbits. No other badger activity was recorded within this area.

10.4.313 Further badger survey work was completed in this area in 2015. A very large active main sett was identified within woodland with at least 30 entrances, at least half of these being well used. There were several well-worn pathways between entrances and radiating outwards further into the wood and the surrounding farmland.

10.4.314 Two single disused likely outlier badger holes were recorded east of Junction 23 within the existing M4 verges.

10.4.315 Further signs of badger activity, such as latrines and crossing points/push-throughs, were recorded south of the existing M4 near Junction 23. No other badger evidence was recorded within this area.

10.4.316 Further pre-construction survey would be required to confirm the status of the badger setts identified and to identify any additional setts that may be established in the period prior to commencement of the works.

10.4.317 The badger is protected under the Protection of Badgers Act 1992. The badger is a common species and this protection is mainly concerned with welfare and the prevention of cruelty, rather than conservation. The population of badgers within the corridor of the new section of motorway is considered to be of District (Low) value.

Hedgehog

10.4.318 There were desk study records of hedgehog spread widely across the 2 km search area, with a concentration of records at the western end around Marshfield, Castleton and on the western side of Newport. Hedgehog was also recorded at the eastern end of the search area in Magor, Rogiet and Caldicot.

10.4.319 The Arup 2014 hedgehog survey (Appendix 10.10) covered ten separate areas of potentially suitable habitat within the study area. Hedgehog presence was recorded in one location at Heol Pont-Y-Cwcw near the River Ebbw. In addition, incidental sightings have confirmed hedgehog to be present near Castleton and Cleppa Parc and at Magor in the eastern end of the study area. Given that hedgehog has been recorded within the Gwent Levels near the River Ebbw it was assumed that they are likely to be present throughout the study area.

10.4.320 Hedgehog is partially protected under the Wildlife and Countryside Act 1981 and is a UK BAP and Section 42 list species. The species appears to be in steep decline and the total population is unknown. The biggest threat to hedgehogs is probably habitat loss, with the change from pastoral farming to arable crops and increasing field size with the removal of hedgerows over the last 30 years. The use of chemicals in gardens and for intensive farming kills the creatures hedgehogs need for food and may also poison them directly. Many are also killed on roads.

10.4.321 Given the decline in the population of the hedgehog, and the continuing threats to the species, the population of hedgehog within the corridor of the new section of motorway is considered to be of District (Low) value.

Reptiles

10.4.322 The desk study identified records of four reptile species, which are all partially protected under the Wildlife and Countryside Act from intentional or reckless killing or harm. All are UK BAP Priority Species and listed under Section 42 of the NERC Act and are included in the Trunk Road Estates BAP.

10.4.323 Slow worm was recorded frequently in the western half of the search area with a concentration of records at Gaer Fort SINC, which comprises a mosaic of grassland, heath, bracken and scrub. There were records at Marshfield and at the eastern end of the search area at Vinegar Hill in Magor.

10.4.324 Common lizard was recorded less frequently in the south and west of the search area. Grass snake was recorded frequently across the south of the search area in the Gwent Levels, Newport Wetlands Reserve, Magor Marsh and in Rogiet. Grass snake was recorded infrequently across the north of the search area and at the south east end. Adder was recorded in the south west and centre of the search area and twice at the eastern end of the search area in and near to Slade Wood.

10.4.325 The locations of reptile records (other than grass snake) in the 2014 and 2015 reptile surveys are shown on Figure 10.8. The Arup 2014 reptile survey covered ten separate areas of potentially suitable habitat within the study area (Appendix 10.11). Two species of reptiles were recorded. The most frequently recorded species was grass snake, recorded in five areas (Areas 2, 3, 4, 5 and 7). The highest number of animals seen on any single visit in one area was five, on 28th August in Area 7.

10.4.326 Overall, small numbers of snakes were recorded infrequently during the survey and were not recorded in half of the areas surveyed. Taking a precautionary approach, it was assumed that grass snakes were present in low numbers throughout the study area within suitable habitats.

10.4.327 Single adult common lizards were recorded in Area 9 (eastern edge of Magor Services) on 11th September and Area 5 (former laboratory site at Pye Corner) on 12th September. There were no records of adder or slow worm during the survey.

10.4.328 The 2015 survey within the Tata Steelworks site recorded grass snakes under the artificial refugia. The peak count of grass snakes was six, indicating a good population within the area. Male, female and juvenile grass snakes were observed, indicating that a breeding population is present within the survey area.

10.4.329 Within Newport Docks, common lizard, grass snake and slow worm were observed under artificial refuges. The peak counts of single common lizard, grass snake and slow worm indicate that low population size classes of these reptiles are present within the survey area.

10.4.330 The rest of the land within Newport Docks in the vicinity of the proposed new section of motorway was not suitable habitat for reptiles and the populations are likely to be confined to the grassland and open scrub within the site. However, they are likely to extend further northwards within grassland and scrub areas within the adjoining landfill site and the bank of the River Ebbw outside the survey boundary.

10.4.331 There were a number of incidental sightings of grass snake during other surveys in 2015. These were at Whitecross Farm, west of Pye Corner, near Bareland Street Reen, Tata reedbed and Newport Docks.

10.4.332 All reptile species receive some level of protection under UK law. The species recorded in the corridor of the new section of motorway (grass snake, common lizard and slow-worm) are partially protected under the Wildlife and Countryside Act 1981.

10.4.333 The Trunk Road Estate BAP includes a species action plan for reptiles which has the following objectives:

- identify areas of habitat that are suitable for reptiles within the soft estate;
- adhere to new best practice advice as it is developed (with respect to road construction and maintenance); and
- identify opportunities for enhancement during road design and construction.

10.4.334 The plan includes the following relevant action.

- Identify the likely presence of reptiles early, particularly for schemes where there is no alternative to effects on reptiles, and which would require translocation as a last resort.

10.4.335 The extensive suitable habitat provided by the reens and ditches of the Gwent Levels means that a substantial population of grass snake is likely to be present. This is considered to be of County (Medium) value.

10.4.336 Common lizard and slow worm were found in more localised areas of former industrial land where a mosaic of open and more vegetated areas provides suitable habitat. These populations are considered to be of District (Low) value.

Great Crested Newt and Other Amphibians

10.4.337 The desk study recorded five amphibians (common frog, common toad and great crested, palmate and smooth newts). Great crested newt is a European Protected Species. The remaining four amphibians are protected from sale only under the Wildlife and Countryside Act 1981 (as amended). Five are included in the Trunk Road Estates BAP and great crested newt is also a local BAP species in Monmouthshire. Great crested newt and common toad are UK BAP Priority Species and listed under Section 42 of the NERC Act.

10.4.338 Great crested newt was recorded near Marshfield in the south west of the search area for the desk study; in the centre/north of the search area near Caerleon; in the centre of the search area at Solutia SINC; and in the east of the search area at and around Ifton Quarry. The other amphibians were recorded in several locations in the western half of the search area and at ponds in and around Ifton Quarry to the east. Smooth newt, common frog and common toad were recorded frequently throughout the survey area and palmate newt was recorded in Newport and at Ifton Quarry.

10.4.339 No great crested newts were recorded during the Arup 2014 presence/absence survey despite the presence of suitable habitat and previous records (Appendix 10.6). Populations of smooth/palmate newt were identified in all three of the areas surveyed.

10.4.340 These surveys only covered a small number of waterbodies within the survey area due to limitations on access at the time.

10.4.341 The report of the 2015 survey utilising the eDNA analysis technique is provided at Appendix 10.22. Locations of positive records of great crested newt eDNA are shown on Figure 10.8.

10.4.342 The analysis of the results identified water samples from four waterbodies (out of a total of 283 that were sampled) to be positive for great crested newt presence. Three of the four waterbodies found to support great crested newt were located at the eastern end of the survey area near Magor. One was near Nash.

10.4.343 None of the waterbodies found to support great crested newt eDNA were located within the footprint of new section of motorway but were located within 250 m of it.

10.4.344 During the reptile survey, a female and a juvenile great crested newt were recorded twice under the same mat within the eastern survey area within the Tata steelworks land. This location is also shown on the plan at Figure 10.8.

10.4.345 Further surveys will be undertaken in 2016 in those areas where waterbodies tested positive for great crested newt to determine the population size class.

10.4.346 The Trunk Road BAP includes a species action plan for amphibians, the objectives of which are to protect and, where possible, enhance amphibian habitat on the soft estate (including migration routes) as well as providing mitigation for existing amphibian road-kill black spots.

10.4.347 The plan includes the following relevant actions.

- Where a road will unavoidably destroy or degrade amphibian habitat, consider the creation of new breeding waters, artificial hibernacula and suitable foraging habitat (these may be incorporated into the soft estate depending on the species involved).
- Where existing amphibian road-kill black spots are known, consider building mitigation measures into the road: these may include tunnels, fencing and road signs.
- Take into account the possible impacts of alterations to drainage or water levels on the surrounding amphibian populations during construction and maintenance operations
- Consider the provision of habitats suitable for amphibians (both for foraging and hibernating) when managing the soft estate, to enhance the area for the local amphibian population.
- Ensure measures are in place to prevent road runoff pollution events in line with best practice in new schemes.

10.4.348 Recognising that great crested newt is a European Protected Species, but that surveys indicate only localised populations within the survey area, the population is considered to be of County (Medium) value.

10.4.349 Recognising the protection afforded to amphibian species, and the extensive habitat available for amphibians generally, the community of other amphibians is considered to be of District (Low) value.

Birds

10.4.350 The desk study identified records of 117 species of protected and notable birds within 2 km of the existing M4 and 120 species within 2 km of the proposed new section of motorway.

10.4.351 For the existing M4, 66 were protected and priority species with 35 listed on Annex 1 of the Birds Directive and/or specially protected under the Wildlife and Countryside Act 1981 (as amended). A total of 51 records were other species of conservation concern due to being Red or Amber listed under the RSPB Birds of Conservation Concern (BOCC) or because they were Red Data Book species.

10.4.352 For the new section of motorway, 81 were protected and priority species with 49 listed on Annex 1 of the Birds Directive and/or specially protected under the Wildlife and Countryside Act 1981 (as amended). A total of 54 records were other species of conservation concern due to being Local BAP Species, Red or Amber listed under the BOCC or because they were Red Data Book species.

10.4.353 The bird records were distributed across the search area with concentrations of records around Magor Marsh in the east, Newport Wetlands Reserve, around Newport and around Marshfield at the western end of the search area, and across the Gwent Levels generally.

10.4.354 A wide variety of birds were recorded including birds of prey, waterbirds, and those associated with farmland, woodland and parklands/gardens.

Breeding Birds

10.4.355 A total of 75 species were recorded during the breeding bird surveys carried out between April and June 2014 (Appendix 10.13). Of these, 52 species were considered likely to be breeding within the study area.

10.4.356 Two of these 75 species are named components of the Severn Estuary Ramsar site during the breeding season (herring gull and lesser black backed gull, the latter being a species for consideration for inclusion), though neither species was recorded breeding or exhibiting behaviour associated with breeding in the study area. Only one other species was recorded that is a named component of the Severn Estuary Ramsar site (little egret - which is named as a spring/passage component). No breeding activity of this species was recorded. No other noteworthy spring/autumn components of the Severn Estuary SPA and/or Ramsar site were recorded.

10.4.357 There were no records of the riverine bird species named of the citation for the River Usk SSSI (Lower Usk), namely kingfisher, grey wagtail or dipper.

10.4.358 Four species (lapwing, redshank, water rail and Cetti's warbler) were recorded that are named within the Newport Wetlands SSSI citation. Redshank also appears on both the Severn Estuary SPA and Ramsar site citation, lapwing on the SPA citation, and water rail on the Ramsar citation, but as wintering species.

10.4.359 A single pair of lapwings was recorded within the survey area, with additional birds associated with open fields. A single record of a singing redshank was made. Water rails were only encountered on the first survey visit in April, with two birds heard calling from dense reed habitat. Based on the data collected during the 2014 breeding season, the study area does not represent a breeding stronghold for any of these species.

10.4.360 Cetti's warblers were recorded from six transects and breeding was considered likely to occur in all of these areas. High numbers were recorded in reedbed, scrub and swamp habitat south of the Tata Llanwern steelworks. A maximum count of 20 singing males was made on both 11th April and 16th May (from Transect 5) and 24 singing males on 11th April (from Transect 6). It was assumed that all singing males represent a breeding pair. Because of known behavioural traits, Cetti's warbler is a species where double counting of birds is known to be an issue. Despite this, it is clear that there was a substantial population of breeding birds present in the study area in 2014. Based on a peak count of 24 pairs, up to 1.2% of the GB population of 2000 males (Musgrove *et al.*, 2013) were present within the study area.

10.4.361 Two species found on Schedule 1 of the Wildlife and Countryside Act were recorded in 2014 in addition to Cetti's warbler: peregrine and common crossbill. Only a single flight by a single peregrine was recorded, with no evidence of breeding noted. A flock of four common crossbills was recorded They are known to breed as early as February, so observations from April 2014 suggest that this was a post-breeding flock and that, whilst breeding within the study area was possible, it is unconfirmed. The GB breeding population of common crossbill consists of 39,000 pairs (Musgrove *et al*., 2013).

10.4.362 Ten bird species recorded during the 2014 breeding bird surveys are on the Red list of Birds of Conservation Concern (BoCC); of which nine were recorded breeding. These were cuckoo (three singing males recorded), grasshopper

warbler (one record of a singing male), house sparrow (ten singing males, likely to be an underestimate), lapwing, linnet (small numbers, in addition to a post breeding flock), lesser redpoll (one singing male), skylark (small numbers of records on two transects, with additional records over farmland fields) and starling (four pairs across study area in total, adults. 24 Amber list species were recorded, of which 13 were recorded breeding. 12 species were recorded that are Section 42 priority species, of which ten bred within the study area.

10.4.363 Although not intended as a breeding bird survey, the wintering bird survey of April 2015 provides data within it that is useful in the assessment of the breeding bird assemblage of the study area. These surveys identified a peak count of 25 Cetti's warblers, observations which are comparable with the data collected for this species during the 2014 breeding season. Of the other species identified during this survey, shelduck are known to breed in the area and are also listed as a named wintering component of the Severn Estuary SPA and Ramsar site. It should be noted that no breeding activity of this species was recorded.

10.4.364 In the breeding bird surveys carried out in May and June 2015, 46 species of bird were recorded, of which 43 were judged to be breeding or possibly breeding within the study area. As with the 2014 breeding bird surveys, little egret was recorded, albeit only a single observation of one bird flying over the study area. Breeding behaviour was not exhibited. This was the only bird species recorded that is named as a spring/autumn component of the Severn Estuary SPA and/or Ramsar citation. A single little egret was also observed in flight during the wintering survey conducted in April 2015.

10.4.365 The only species recorded and named during the 2015 breeding bird surveys that appears on the Severn Estuary SPA and/or Ramsar citation was lapwing, which was recorded breeding in low numbers at the eastern and western extents of the site.

10.4.366 In addition, a single Cetti's warbler was recorded during the formal breeding bird surveys in 2015. This contrasts with the large numbers of this species that were reported in April 2015 during the final wintering survey, but this contrast is likely to be due to behavioural differences and Cetti's warbler being an early breeder.

10.4.367 Two species on Schedule 1 of the Wildlife and Countryside Act were recorded during the 2015 breeding season: peregrine and Cetti's warbler. A single peregrine was recorded carrying food in the survey area, though it was noted that breeding was not occurring within the study area.

10.4.368 Six species were recorded that are on the Red list of Birds of Conservation Concern and 14 Amber list species were recorded. Ten species were recorded that are Section 42 priority species. All species were recorded in low numbers.

10.4.369 In addition to the breeding bird surveys in 2015, breeding wader surveys were carried out. Two of the four areas surveyed contained waders, with lapwing present at both, and curlew present at one. Lapwings were present in suitable breeding habitat on multiple occasions, whilst curlews were observed flying over the study area only. Both of these species are named on the Severn Estuary SPA and Ramsar site citations.

10.4.370 Overall, the assemblage of breeding birds recorded in the study area throughout 2014 and 2015 is typical of the habitats surveyed. The survey transects supported a range of species associated with hedgerows, farmland, scrub and

urban areas. None of the survey transects supported notably high densities of farmland indicator species, such as skylark or linnet.

10.4.371 The study area included parts of the Gwent Levels. Very low levels of wader activity were recorded, with just a single pair of lapwing recorded breeding in 2014, and nine records across two breeding wader survey areas in 2015. The 2015 surveys also identified a single curlew record. Likewise few breeding waterfowl were recorded. The areas studied were relatively enclosed and thus less favourable to waders.

10.4.372 Woodland at the western end of the survey area generated records of a somewhat different breeding bird assemblage. Notably, this included a small number of common crossbills in April 2014 that may have bred in the area. However, this is not a confirmed record as the timing of crossbill breeding suggests that this could have been a post-breeding flock whose breeding grounds were located beyond the study area.

10.4.373 The area to the south of the Tata Llanwern steelworks was dominated by reedbed, swamp and open water habitats. Of particular note were the high counts of Cetti's warbler and other birds of conservation concern recorded in this area (water rail, cuckoo, grasshopper warbler and reed bunting).

10.4.374 The Llanwern area is known to be stronghold in Gwent for Cetti's warbler. The 2012 county bird report (Gwent Ornithological Society, 2012) stated that 20 singing birds were recorded in March with another 30 singing birds at the Newport Wetlands Reserve. The species is described in the county bird report as an uncommon breeding resident but has shown recent range expansion. In common with the results presented here, all singing birds reported are considered indicative of breeding pairs within the county bird report.

10.4.375 Using the DMRB definitions to classify the value of the populations in the study area by species, it is judged that the population of Cetti's warbler present in the study area is of National (High) value.

10.4.376 Using the DMRB definitions, the value of all remaining species recorded within the study area during the breeding season has been judged to be District (Low).

10.4.377 The results of the barn owl survey (Appendix 10.29) and the other 2014 and 2015 breeding bird surveys indicate that a barn owl nest may be located in a poplar tree near Greenmoor Farm.

10.4.378 The Trunk Road Estate BAP includes a species action plan for barn owl, the objectives of which are to gather more information about the presence of barn owls on the trunk road network, and to reduce the level and incidence of mortality on roads whilst managing the soft estate for barn owls where it is safe to do so, and where the risk of road-related casualties is low.

10.4.379 The plan includes the following relevant action.

- Where new road developments are planned, ensure prior desk studies and surveys determine any likely impacts on the local barn owl population and options available for the mitigation of these impacts.

10.4.380 Taking into account the protected status of barn owl, the status of the species in the vicinity of the proposed motorway is valued as County (Medium) value.

Wintering Birds

Arup: January – March 2014 Survey

10.4.381 A total of 68 species was recorded during the three winter walkover and vantage point surveys conducted between January and March 2014 (Appendix 10.12). Of these, three were named components of the Severn Estuary SPA and Ramsar citations (redshank, gadwall and shelduck).

10.4.382 In 2014, redshanks were observed using the River Ebbw in the greatest numbers of any bird named in the Severn Estuary SPA and/or Ramsar citations. Two mid to high tide redshank roosts were recorded, one of which was in the vicinity of the proposed bridge crossing, the other near the mouth of the river several hundred metres downstream from the proposed crossing. Redshank activity was much lower at the River Usk vantage point.

10.4.383 The latest Severn Estuary SPA redshank population estimate of 2,536 (an increase from 2,013 birds in the original SPA citation) represents 2.11% of the estimated GB population of 120,000 birds (Musgrove *et al.,* 2013). According to BirdLife, the European population of this species is between 280,000 and 610,000. The maximum count of redshank recorded during the 2014 winter walkover surveys (130) represents 5.13% of the latest SPA population estimate.

10.4.384 Gadwalls were recorded in small numbers during the winter walkover surveys of 2014 (maximum count of two birds). No birds were recorded at either of the vantage point locations. The winter walkover maximum count represents 0.83% of the 241 birds estimated to make up the Severn Estuary SPA site population at the last estimate (population estimate at citation was 330 birds), which in turn represents 0.96% of the estimated GB population of 25,000 birds (Musgrove *et al*., 2013).

10.4.385 Shelducks were only recorded at the River Ebbw vantage point during the 2014 winter surveys, with a maximum count of two birds. This sighting represents 0.06% of the latest Severn Estuary SPA site population estimate of 3,330 birds (up from 2,892 at SPA citation). The SPA population represents 5.45% of the GB shelduck population of 61,000 birds (Musgrove *et al.,* 2013). Shelduck were not recorded anywhere else in the study area in during the wintering surveys of 2014.

10.4.386 Six species were identified during the winter 2014 surveys that are named components of the SPA and/or Ramsar site assemblage. These were teal (named assemblage component on both citations, identified as a named component of future consideration for the Ramsar site), mallard (named assemblage component on SPA citation only), grey plover (named assemblage component on SPA citation only), curlew (noteworthy species for spring/autumn only on Ramsar citation, present on SPA citation), little egret (noteworthy species for spring/autumn only on Ramsar citation), spotted redshank and lapwing (named assemblage component on SPA citation only).

10.4.387 During the 2014 winter surveys, a maximum count of 57 teals was recorded. Birds were mainly observed foraging and roosting within the River Ebbw during vantage point surveys. No teals were recorded at the River Usk during vantage point surveys. The maximum count during the winter walkover surveys was 40 birds, which represents 0.90% of the latest Severn Estuary SPA population of 4,459 birds. At citation, the SPA population estimate was 1,998 birds. No teal were recorded at the River Usk. The GB population estimate of teal is 210,000

(Musgrove *et al.,* 2013), therefore the latest SPA population represents 2.12% of the GB population.

10.4.388 Lapwings, (maximum count 28) were recorded in the grazing pasture to the west of the River Ebbw during the winter walkover surveys of 2014. Low numbers of lapwings were also seen at the River Ebbw (four flights in total) during the 2014 winter vantage point surveys. As lapwings were added to the Severn Estuary SPA assemblage as a component after citation, no population estimate at citation is available. The latest SPA population estimate is 10,471 birds. The lapwings recorded in the study area represent 0.27% of the latest Severn Estuary SPA population estimate. The estimated GB population of this species is 620,000 (Musgrove *et al.,* 2013), meaning that 1.68% of the GB population of this species are associated with the Severn Estuary SPA.

10.4.389 During the winter 2014 surveys, mallards were observed in the most number of fields spread throughout the survey area of all species, with higher numbers observed around waterbodies and within the reen network of the Gwent Levels SSSIs. The maximum count during the winter walkover surveys was 12 birds. As mallards were added to the Severn Estuary SPA assemblage as a component after citation, no population estimate at citation is available. The latest Severn Estuary SPA population estimate is 2,713 birds. The maximum count for the study area represents 0.44% of the Severn Estuary population of mallards. The GB national population estimate is 680,000 (Musgrove *et al.,* 2013). This species was also recorded at the River Usk (13 flights) and River Ebbw (10 flights) vantage points during the winter 2014 surveys.

10.4.390 Little egrets were recorded in small numbers during the 2014 winter surveys, with a maximum count of two birds during the winter walkover surveys. Little egret are named as a component of the Severn Estuary Ramsar assemblage during spring/autumn, with a latest population estimate of 56 birds. Therefore the maximum count of the study area represents 3.58% of the Severn Estuary Ramsar population. The estimated GB population is 4,500 (Musgrove *et al.,* 2013). The Severn Estuary Ramsar population represents 1.24% of this total. During the River Ebbw vantage point surveys 19 flights were recorded. These were mostly single birds.

10.4.391 Curlews were not observed during the winter walkover surveys in 2014, but were recorded at both vantage point locations in low numbers (maximum count of 1 bird at both vantage points). This peak represents <0.01% of the 3,768 birds estimated to make up the Severn Estuary SPA population at the last estimate, which in turn accounts for 2.79% of the GB population estimate of 140,000 (Musgrove *et al.,* 2013).

10.4.392 Grey plovers were recorded once during the 2014 winter surveys. A flight of six birds was recorded during a River Ebbw vantage point survey. This species was not recorded during winter walkover surveys. At citation, the SPA population estimate was 781 birds. The estimated GB population is 43,000 (Musgrove *et al.,* 2013).

10.4.393 Spotted redshank was observed during a vantage point survey. This was the only record of this species during the 2014 winter surveys. The estimated GB population is 98 (Musgrove *et al.,* 2013).

10.4.394 A further 10 species were recorded that may be considered part of the waterfowl and waterbird assemblage of the Severn Estuary SPA and Ramsar site (mute swan, coot, cormorant, little grebe, moorhen, common sandpiper, grey heron, greylag goose, snipe and oystercatcher). These species were all present in relatively low numbers, with maximum counts of 41 mute swans and 17 greylag geese. All other species maximum counts were below 10 individuals.

10.4.395 Cetti's warbler, a named component of the Newport Wetlands SSSI during the breeding season, and listed in Schedule 1 of the Wildlife and Countryside Act, was recorded during the winter walkover surveys. A total of three observations near to the River Usk were made in January and March 2014.

10.4.396 Other species recorded in flocks of greater than 50 birds during the winter 2014 surveys included fieldfare (maximum count 200 birds), starling (maximum count 350), redwing (maximum count 200), black-headed gull (maximum count 300), common gull (maximum count 300) and herring gull (maximum count 250). In the context of the study area, these species are all regarded as being of District (Low) value.

Hyder 2014/2015 Survey

10.4.397 During the 2014/2015 winter surveys (Appendix 10.16), the named components of the Severn Estuary SPA and/or Ramsar citation recorded were redshank, gadwall, pintail, shelduck and dunlin.

10.4.398 A maximum count of 38 redshanks was recorded during the 2014/2015 winter walkover surveys, representing 1.50% of the Severn Estuary SPA population estimate of 2,536.

10.4.399 The majority of redshank observations were on the banks of the River Ebbw, with a small number also recorded foraging in the sludge beds to the east of the River Usk. This distribution is similar to that recorded during the winter 2014 surveys. Redshank was the most frequently recorded species named on the Severn Estuary SPA and/or Ramsar citations during the vantage point surveys, recorded during all of the survey visits at both river crossings, with a peak count of 690 birds on the River Ebbw and 161 birds on the River Usk. These counts are substantially higher than those reported in the winter 2014 surveys. However, this is likely due to the increased survey effort deployed in 2014/2015.

10.4.400 On the River Ebbw, the birds were recorded foraging and roosting throughout the vantage point survey area, favouring the areas just to the north and south of the crossing point. On the River Usk, the birds were also recorded foraging and roosting throughout the vantage point survey area, but appeared to favour the area just to the north of the crossing point.

10.4.401 During the winter 2014/2015 vantage point surveys of the river crossing locations, gadwalls were only recorded at the River Ebbw. The single bird was recorded commuting over the River Ebbw at a height of 20-100 m. Use of the two rivers in the vicinity of the proposed crossings in both survey years was low. During the 2014/15 transect surveys, gadwall were recorded throughout September to December (inclusive). There was a peak count of 33 birds in October, which represents 13.69% of the wintering Severn Estuary SPA population of 241 birds.

10.4.402 During the 2014/2015 winter walkover surveys pintails were only recorded in one section of the study area, with the birds recorded foraging and roosting to the

south of the Llanwern steel site. The maximum count was 25 birds. This represents 4.89% of the Severn Estuary mean peak count of 511 birds between 2008/2009 and 2012/2013. The GB population estimate for pintail is 29,000 birds (Musgrove *et al.,* 2013).

10.4.403 Shelducks were recorded in two areas during the 2014/2015 winter walkover surveys, with a peak count of 13 birds, which represents 0.39% of the latest SPA/Ramsar population of 3,330 birds. During vantage point surveys, shelduck were recorded on the River Usk only, with a peak count of four birds. These very low numbers are comparable with those recorded for this species during the winter 2014 surveys.

10.4.404 During the 2014/2015 vantage point surveys of the river crossing locations, dunlins were recorded at both river crossing locations. On the River Ebbw, dunlins were recorded with a peak count of 12 birds during the December visit. On the River Usk, dunlins were recorded flying through during the September to December, February and March surveys, with a peak count of 77 birds during the December visit. No dunlins were recorded during the 2014/15 transect surveys.

10.4.405 Nine of the species listed on the Severn Estuary SPA and/or Ramsar waterfowl assemblage qualification were also recorded in small numbers during the 2014/2015 winter surveys. These were teal (named assemblage component on both citations, identified as a named component of future consideration for the Ramsar site), lapwing (named assemblage component on SPA citation only), mallard (named assemblage component on SPA citation only), pochard (named assemblage component on both citations), wigeon (named assemblage component on both citations), tufted duck (named assemblage component on SPA citation only), curlew (noteworthy species for spring/autumn only on Ramsar citation, present on SPA citation), shoveler (named assemblage component on both citations) and ringed plover (named assemblage component on SPA citation only, candidate for named passage component status of Ramsar site).

10.4.406 During the winter 2014/2015 winter walkover surveys, teals were distributed across the site, but appeared to favour the wet ditches to the south of the Tata Steel site. The maximum count was 102 birds, representing 2.29% of the latest Severn Estuary SPA population estimate of 4,459 birds. During the winter 2014/2015 vantage point surveys, teals were regularly recoded at both crossing points. At the River Ebbw, a maximum count of 79 birds was recorded flying through the survey area, as well as being regularly recorded foraging and roosting to the north and south of the crossing location. At the River Usk, the maximum count was 34 birds.

10.4.407 During the winter 2014/2015 winter vantage point surveys, lapwings were recorded at both crossing locations. At the River Ebbw, birds were recorded commuting, with a maximum count of 50 birds. At the River Usk, the maximum count was 100 birds, which were recorded foraging on the banks of the river. During the 2014/2015 winter walkover surveys, the maximum count was 100 birds. This represents 0.96% of the Severn Estuary SPA latest population estimate of 10,471 birds. Compared to the rest of the study area, this species appears to prefer the areas in the vicinity of the River Usk and the River Ebbw.

10.4.408 During the 2014/2015 vantage point surveys, mallards were recorded at both crossing locations. At the River Ebbw the maximum count was 59 birds. At the River Usk mallards were present in small numbers, with a maximum count of 41

birds. During the 2014/15 transect surveys mallards were recorded during the all of the survey visits. A peak count of 60 birds was recorded, representing 2.21% of the latest Severn Estuary SPA population estimate of 2,713 birds.

10.4.409 During the winter walkover surveys of 2014/2015, a maximum count of 28 pochards was recorded. This represents 4.92% of the latest Severn Estuary SPA population. No pochards were recorded during the 2014/15 vantage point surveys. This species was not recorded during the winter 2014 surveys.

10.4.410 During the 2014/2015 winter walkover surveys, the maximum count of wigeons was 25 birds. This represents 0.32% of the latest Severn Estuary SPA population estimate. During the 2014/15 vantage point surveys, a single wigeon was recorded at both crossing locations. This species was not recorded during the winter 2014 surveys.

10.4.411 During the 2014/15 transect surveys, a maximum count of 15 tufted ducks was recorded. This represents 1.89% of the latest Severn Estuary SPA population estimate for this species. No tufted ducks were recorded during the winter 2014/2015 vantage point surveys of the river crossing locations. This species was not recorded during the winter 2014 surveys.

10.4.412 A maximum count of 12 curlews was recorded during the 2014/2015 winter walkovers, representing 0.32% of the latest Severn Estuary SPA population of 3,768 birds. The sightings were in fields in the vicinity of the mouth of the River Ebbw. On the River Ebbw itself, a maximum count of 125 birds was recorded during vantage point surveys, with smaller numbers of birds regularly observed foraging and roosting south of the proposed crossing point. On the River Usk, a maximum count of 16 curlews was recorded, with the birds appearing to favour the east bank.

10.4.413 During the 2014/2015 transect surveys a maximum count of six shovelers was recorded. This represents 1.34% of the population of 448 birds estimated to winter in the Severn Estuary SPA. No shovelers were recorded during the 2014/15 vantage point surveys. Shoveler was not recorded in the 2014 winter surveys.

10.4.414 Whilst not recorded during the 2014/2015 winter walkover surveys ringed plovers were recorded at both vantage point locations in small numbers. Ringed plover is only named as a passage component of the Severn Estuary SPA.

10.4.415 Twenty four other waterfowl and wader species, not specifically listed as forming part of the Severn Estuary SPA assemblage on the SPA citation were also recorded during the 2014/2015 winter surveys. These were mute swan, black swan, Canada goose, greylag goose, goosander, oystercatcher, ruff, common sandpiper, green sandpiper, greenshank, little ringed plover, bar-tailed godwit, black-tailed godwit, jack snipe, snipe, water rail, little egret, grey heron, night heron, moorhen, coot, cormorant, little grebe and great-crested grebe.

10.4.416 Overall, the surveys identified that the land within and adjacent to the footprint of the proposed new section of motorway supported a suite of overwintering farmland and other notable bird species of nature conservation importance (including a number of species listed on the Red List and Amber List of the Birds of Conservation Concern (Eaton *et al*., 2015), and as priority species under Section 42 of the NERC Act 2006) throughout the winter period.

10.4.417 Although by definition the Severn Estuary SPA and Ramsar site supports a number of internationally important populations of a number of species, the proposed new section of motorway is not located within the SPA or Ramsar site. Therefore, the vast majority of these populations do not occur within the study area. As a result, the numbers of birds actually seen within the study area is used along with the latest Severn Estuary SPA population estimate for each species to determine the proportion of the SPA population using the study area during the maximum count of that particular species recorded during winter walkover surveys. Maximum counts from vantage point surveys, whilst used above in the text to provide evidence of low populations around the proposed crossing areas, are not suitable for determining peak population sizes due to double counting and consequent overestimation of populations. The use of the maximum count reflects a very much worst case scenario. For all species the number of birds that typically use the site is much lower. In addition, the latest national (GB) population estimates are presented to provide further context on national importance of the SPA population.

10.4.418 The peak maximum counts of these species relative to Severn Estuary and GB population estimates, as well as the value of these populations, is summarised in Table 10.9 for named SPA and/or Ramsar components and Table 10.10 for named SPA and/or Ramsar assemblage components.

10.4.419 The value of the population of each species within the study area has been calculated according to the maximum transect survey counts recorded within the study area, relative to the estimated population size of the Severn Estuary SPA, as well as expert opinion. The general rules of classification were as follows:

- Named qualifying species and those species named in the SPA assemblage where the maximum count represented >5% of the SPA population were classified as being of High value.
- Species where the study area maximum count represented 1-5% of the SPA population were classified as being of Medium value.
- Low value was assigned to species whose maximum count in the study area represented <1% of the SPA population.

10.4.420 There are exceptions to these rules. For instance, in the case of pintail, the maximum count was very close to the 5% threshold, therefore it is was assigned High value on a precautionary basis. In the case of mallard it is known that the GB population is high, and the population of the Severn Estuary SPA is not significant to the success of the species; therefore the study area population was classified as being of Low value.

Table 10.9: Summary of Named SPA and Ramsar Components

Species	Study Area Maximum Count	Severn Estuary SPA Population Estimate	% of SPA Population in Study Area Maximum Count	GB Population Estimate	Value of Study Area Population
Bewick's Swan	0	289*	0.00%	7,000	N/A
European White-fronted Goose	0	3,002*	0.00%	16,000	N/A
Dunlin	0	26,412	0.00%	350,000	N/A
Redshank	130	2,536	5.13%	120,000	High
Shelduck	13	3,330	0.39%	61,000	Low
Gadwall	33	241	13.69%	25,000	High
Pintail	25	511	4.89%	29,000	High
*original SPA populations at citation.					

Table 10.10: Summary of Named SPA and Ramsar Assemblage Components

Species	Study Area Maximum Count	Severn Estuary SPA Population Estimate	% of SPA Population in Study Area Maximum Count	GB Population Estimate	Value of Study Area Population
Wigeon	25	7,837	0.32%	440,000	Low
Teal	102	4,459	2.29%	210,000	Medium
Pochard	28	569	4.92%	38,000	Medium
Tufted Duck	15	793	1.89%	110,000	Medium
Ringed Plover	0	1,335	0.00%	34,000	N/A
Grey Plover	0	781*	0.00%	43,000	N/A
Curlew	12	3,768	0.32%	140,000	Low
Whimbrel	0	246*	0.00%	30	N/A
Spotted Redshank	0	3*	0.00%	98	N/A
Lapwing	100	10,471	0.96%	620,000	Low
Mallard	59	2,713	2.17%	680,000	Low
Shoveler	6	448	1.34%	18,000	Medium
*original SPA populations at citation.					

10.4.421 The species value within the study area is National (High) for three wintering species. These are redshank, gadwall and pintail.

10.4.422 The species value within the study area is County (Medium) for four wintering species. These are teal, pochard, tufted duck and shoveler.

10.4.423 The species value within the study area is District (Low) for five wintering species. These are shelduck, wigeon, curlew, lapwing and mallard.

10.4.424 The value of the unnamed Severn Estuary SPA and Ramsar wintering assemblage population in the study area has been judged to be District (Low).

10.4.425 The value of all remaining species recorded within the study area during the winter has been judged to be District (Low).

10.4.426 A further wintering bird survey is being carried out over the winter 2015/2016 to provide data for two full winters and will be reported separately once completed.

Freshwater Fish

10.4.427 The Trunk Road Estate BAP includes a species action plan for aquatic species including:

- salmonids (i.e. salmon, trout, grayling and charr); and
- other fish (i.e. allis and twaite shad and bullhead).

10.4.428 The objectives of the plan are to avoid any detrimental impacts of new road construction, road improvements and road operation on aquatic systems and their species; and to identify opportunities throughout each phase of road construction for enhancement of existing habitats and the provision of effective mitigation.

10.4.429 The plan includes the relevant actions.

- During the design phase of a road scheme, assess the impacts upon aquatic species, particularly at river crossing points, at both desk study and field survey phases.
- During construction, in consultation with Environment Agency Wales and CCW, ensure as little disruption as possible to aquatic species occurs. Maintain water quality, and the ability of species to move along rivers and waterbodies, throughout construction. Ensure footings do not significantly encroach on watercourses.
- Ensure that, following construction, runoff from roads does not directly enter watercourses.

Reens and Ditches

10.4.430 The desk study identified one notable fish species (European eel) within the 2 km search area. This is listed under Section 42 of the NERC Act. It is also a UK BAP species and a Red Data Book species. European eel was recorded in one location along a watercourse in the centre/east of the survey area, south of the Tata steel works.

10.4.431 There is a general lack of data relating to the fish associated with the reen systems of the Gwent Levels; the scientific literature focuses mostly on the ecology of the macrophyte and invertebrate species within such habitats. The ecology of specific reens is often dependant on the frequency with which they are maintained or dredged, as this will impact on the type of communities that will flourish in a particular reen based on the frequency of disturbance, vegetation cover and food availability (CWLIDB, 2010).

10.4.432 The reens are, however, known to support a mixed population of coarse fish, including roach, tench, bream and carp; all characteristic of slow-flowing or still water. The reens also support a large population of European eel, which dominate the fish stocks in these features (NRW *pers. comm.,* 2015). The results of two fyke net surveys, undertaken by CCW in the summers of 2008 and 2009 in the Rhosog Fawr Reen (Rumney and Peterstone SSSI) support these broad conclusions with European eel recorded in both years as well as roach, rudd and

perch (NRW, 2015). Three-spined stickleback were also noted during these surveys (NRW, 2015).

10.4.433 The conservation designations for the Severn Estuary and its tributaries include the following species: sea, river and brook lamprey, twaite and allis shad, sea trout, Atlantic salmon, European eel, and bullhead. While not all of these species are likely to occur within the watercourses of the study area, reens and ditches may be significant habitats in terms of native or spawning ranges as follows.

- Juvenile lamprey (ammocoetes) of all three species (river, brook and sea) lie buried in mud for three to five years during their development and may occur in small, silted watercourses.
- European eel spend up to 12 years in still and flowing fresh waters once they return from the sea as glass eels. This species is known to cross waterlogged land and can therefore occur in very small or isolated waterbodies.

10.4.434 Bullhead prefer faster flowing water with larger substrate types to seek refuge, and are therefore considered unlikely to occur in the still waters of reens and ditches.

10.4.435 There are a number of species of migratory fish that transit through the lower reaches of the River Usk in particular, but also potentially the River Ebbw, to reach natal freshwater spawning grounds. These include Atlantic salmon, twaite shad, allis shad, river lamprey, sea lamprey and sea trout. These species are, however, unlikely to occur within reens and slow-flowing waterbodies, as they prefer either estuarine or fast flowing rivers with gravelly substrate suitable for spawning. As these species are transitory through the new section of motorway study area, they are described in full in the migratory fish section below.

10.4.436 Llanmartin Brook, which merges into Monks Ditch and becomes part of the Caldicot Levels drainage system, has previously been considered to be the most diverse in the southern Gwent area for freshwater fish fauna (SEWBReC, 2010). Species recorded in the upper parts of this brook include the minnow, stone loach, European eel, bullhead, gudgeon and brown trout. The majority of these species favour sandy and gravelly rivers and streams, feeding on the bottom and spawning amongst sand, gravel/stone and vegetation. SEWBReC (2010) found three-spined stickleback, with nine-spined stickleback and roach more common further downstream in the Monks Ditch area (SEWBReC, 2010). Records from 2006 from the brook around Underwood also indicated signs of approximately six spawning brook lamprey.

10.4.437 Recognising that the eels that occur in the reens and ditches of the Gwent Levels are part of the population that is one of the reasons for notification of the Severn Estuary Ramsar site, this population should be considered to be of International (Very high) value. Given the diversity of the fish populations in some of the other watercourses and the extent of freshwater habitat, these should be considered to be of County (Medium) value.

Rivers

10.4.438 Other freshwater fish species that are common in larger rivers and are likely to be present in parts of the River Usk and the River Ebbw as opposed to the small reen and ditch habitats of the Gwent Levels wetlands include species such as dace, pike, the spined loach, chub and barbell (SEWBReC, 2010). These

species have been recorded during NRW (formerly Environment Agency) surveys of the River Ebbw (NRW, 2015). Rudd and tench are also common freshwater species to the area, although these have generally been recorded further north after being introduced to local reservoirs and rivers as game fish (SEWBReC, 2010).

10.4.439 Demersal species include the gudgeon, bullhead, minnow and the nocturnal stone loach, which inhabit small to medium sized flowing rivers and larger lake environments (Freyhof *et al.,* 2005; Fish-UK, 2015). The minnow, gudgeon and bullhead are demersal spawners and as such prefer clean substrate in flowing water for spawning, sometimes migrating upstream to spawn. Stone loach prefer sandy substrates or vegetation cover for spawning as this species spawns close to the surface. From here the eggs then drift and attach to various substrates, then progress to gravel substrate with fast flowing water when the benthic larvae are juveniles. Minnow spawn in gravel and also overwinter in coarse substrates but prefer slower moving waters for this purpose (Kottelat and Freyhof, 2007). Minnow is also known to occur in association with salmonid species such as the brown trout present in the Rivers Ebbw and Usk, and generally feeds on algae and plant debris and small freshwater invertebrates, although it is a common prey item itself (Billard, 1997; CRT, 2015). Data provided by NRW (2015) indicate high catches of minnow during some surveys (up to 150 individuals per minute). Gudgeon and brown trout spawn over sandy and gravelly substrate in shallow water (Frank-Gopolos *et al.,* 2015; Fish-UK, 2015).

10.4.440 Bullhead is widespread throughout the River Usk, with the exception of the estuarine area surrounding the mouth of the river. This species is named within the site accounts for the River Usk/Afon Wysg SAC and the River Wye/Afon Gwy SAC and, like minnow, prefers coarse gravelly substrate, although in the southern reaches of the Usk it is thought that this species may prefer softer substrate with abundant vegetation cover (JNCC, 2015). The River Usk is considered to have exceptionally high quality habitat with good water quality, abundant cover and a variety of aquatic habitats.

10.4.441 Stone loach is particularly sensitive to pollution by heavy metals and low oxygen levels, but can tolerate moderate organic pollution and is therefore often considered to be a good indicator of water quality (Wheeler, 1992). Bullhead is also sensitive to oxygenation, preferring a well-oxygenated environment and does not tolerate badly polluted rivers (JNCC, 2015).

10.4.442 The River Usk also supports a healthy population of brook lamprey and is considered to provide exceptionally good quality habitat likely to ensure the continued survival of the species in this part of the UK. Brook lamprey is listed as a primary reason for the selection of the River Usk/Afon Wysg SAC and the River Wye/Afon Gwy SAC. The River Usk has the greatest *Lampetra* species ammocoete (river and brook lamprey ammocoetes cannot be distinguished apart in the field and as such are termed collectively as Lampetra species) population across all British SAC rivers designated for these species (DECC, 2008).

10.4.443 Given the nature conservation importance of the River Usk and that the fish population forms part of the reason for its notification as a SSSI, the freshwater fish community (excluding the migratory species described below) is considered to be of National (High) value.

Migratory Fish

10.4.444 There are a number of species of migratory fish that transit through the lower reaches of the River Usk in particular, but also potentially the River Ebbw, to reach natal freshwater spawning grounds. These include Atlantic salmon, twaite shad, allis shad, river lamprey, sea lamprey and brown/sea trout. Data provided by NRW (2015) from timed fyke net surveys in the River Ebbw between 1996 and 2007 (all sites north of the existing M4) show brown/sea trout to be frequently recorded (up to 1.4 fish caught per minute); European eel were also recorded in the River Ebbw fyke net surveys.

10.4.445 In general, marine/estuarine fish communities tend to show seasonal fluctuations that are related to movements of species between key feeding, spawning and nursery areas throughout the year. For example, during the spring and summer months many species move into shallower, inshore waters to feed and/or spawn, whilst during winter they migrate further offshore into deeper waters and these changes may be linked to both water temperature and the availability of prey species.

10.4.446 The Bristol Channel/Severn Estuary provides a transitory route for several diadromous fish species, which primarily move between marine feeding grounds and their natal freshwater rivers, notably the River Usk, River Wye and River Severn but also potentially the network of reens and ditches associated with the Gwent Levels. Diadromous species are either anadromous (adults of anadromous species migrate from coastal marine areas to freshwaters to spawn but most growth occurs at sea) or catadromous (adults migrate from freshwaters to marine waters to spawn, but most growth occurs within freshwaters). Seven diadromous fish species are known to occur in the vicinity of the study area: Atlantic salmon, twaite shad, allis shad, river lamprey, sea lamprey, sea trout and European eel. All of these species are anadromous with the exception of the catadromous European eel.

10.4.447 In addition to the River Usk which has been designated as an SAC for, amongst other features, the presence of either all or some of these migratory fish species, there are a number of other rivers entering the Severn Estuary that may also support these diadromous species including the River Ebbw (DECC, 2008). In addition, a number of the diadromous fish species stray during their migratory movement and can enter numerous other estuaries and rivers before returning to their natal river. Therefore, the following sections contain a summary of all migratory fish species with the potential to be in the vicinity of the proposed new section of motorway.

Sea and River Lamprey

10.4.448 Sea and river lamprey are classified as Least Concern on the IUCN Red List, and listed on Appendix III[1] of the Bern Convention and Annex II[2] of the EC Habitats Directive. In addition, river lamprey is on Annex V[3] of the EC Habitats Directive and Schedule 3[4] of the Conservation Regulations (1994) and sea lamprey is a

[1] Protected Faunal Species.
[2] Species known to occur as native populations in the UK and whose conservation requires designation of special areas of conservation.
[3] Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures.
[4] Animals which may not be taken or killed in certain ways.

priority species on the OSPAR list of threatened and declining species. Sea and river lamprey are given as primary reasons for the selection of the River Usk/Afon Wysg SAC, Severn Estuary/Môr Hafren SAC and River Wye/Afon Gwy SAC.

10.4.449 The River Usk in particular, supports a healthy population of river lamprey. The brook lamprey is the smallest of the lampreys found in the UK and is a non-migratory freshwater species, typically occurring in streams. Like sea and river lamprey, brook lamprey requires clean gravel beds for spawning and soft marginal silt or sand for the ammocoete larvae. It spawns mostly in parts of the river where the current is not too strong.

10.4.450 Adult river lamprey generally enter UK rivers in late autumn and peaks in the abundance of juvenile river lamprey migrating downstream have been recorded between October and January (Claridge *et al*., 1986). Sea lamprey migrate upstream and enter rivers such as the Usk and Wye in early spring (Table 10.11). The survey of juveniles and observation of spawning adults indicate that sea lamprey are mainly restricted to the lower reaches of the River Usk catchment. Being poor swimmers, migrating lamprey generally move in shallow waters, along the edges of the main stream, particularly when the river current is strong (Kelly and King, 2001).

Twaite and Allis Shad

10.4.451 Allis and twaite shad are listed as Least Concern on the IUCN Red List, Annexes II and V of the EC Habitats Directive, Appendix III of the Bern Convention, and Schedule V[5] of the Wildlife and Countryside Act (1981). Twaite shad are listed as a primary reason for the selection of the River Usk/Afon Wysg SAC, Severn Estuary/ Môr Hafren SAC and River Wye/Afon Gwy SAC. Allis shad are listed as a qualifying feature, but not as a primary reason for the selection of the River Usk/Afon Wysg SAC and River Wye/Afon Gwy SAC. Allis shad is also a priority species on the OSPAR list of threatened and declining species.

10.4.452 The River Usk is one of only four remaining rivers in the UK that are known to support a spawning population of twaite shad; the others are the Rivers Wye, Tywi and Severn (including its tributary the River Teme).

10.4.453 Allis shad are rare in the UK and, although formerly known to spawn in several British river systems, the only recently confirmed spawning site is in the Tamar Estuary (Plymouth Sound and Estuaries candidate SAC). There is probably a spawning population in the Solway Firth area (Maitland and Lyle, 2001), but rivers in the Severn catchment may no longer support viable breeding populations (Carstairs, 2000). Sites in the UK, such as the River Usk/Afon Wysg SAC, have been selected where allis shad has been reliably recorded as present, where there is previous evidence of breeding and where there still appear to be favourable conditions for breeding.

10.4.454 The upstream migration of allis and twaite shad to spawning areas in the Rivers Severn, Wye and Usk occurs between March and June, reaching a peak in May. Spawning is dependent on temperature but usually occurs between May and July for twaite shad (Aprahamian *et al.,* 1998). The fish remain in fresh and/or estuarine waters during the summer, juveniles colonise the Severn Estuary from July, before migrating seaward in autumn (Table 10.11).

[5] Allis shad is protected from killing, injury, or taking by any method as per Section 9(1) of the WCA 1981, twaite shad is afforded protection under Section 9(4) which prohibits damage/destruction of its place of shelter.

Atlantic Salmon

10.4.455 Atlantic salmon is classified as Least Concern on the IUCN Red List and is listed on Appendix III of the Bern Convention. Freshwater populations are listed on Annex II of the EC Habitats Directive and Schedule 3 of the Conservation Regulations (1994). This species is also a priority species on the OSPAR list of threatened and declining species.

10.4.456 Atlantic salmon is given as a primary reason for the selection of the River Usk/Afon Wysg SAC (and River Wye/Afon Gwy SAC). Adult Atlantic salmon migrate upstream primarily between July and September, but also in earlier months of the year (EDF, 2011). The females excavate hollows in the gravel of the streambed and the males lie alongside and fertilise the eggs as they are laid. Adult Atlantic salmon may die after spawning, but unlike other salmon, a large number of the adults often survive, making their way back to the open sea emaciated and exhausted. Atlantic salmon smolts (life stage which changes body chemistry in preparation for living in salt water) migrate downstream towards marine feeding grounds between April and June; evidence suggests that this migration occurs largely during the night in surface waters (Moore *et al.,* 1998).

10.4.457 The River Usk is famous for its salmon, with a high proportion (approximately 30–40%) of multi sea winter fish recorded in the rod catch. In 1999 the Usk had the highest estimated egg deposition of any British river south of Cumbria, and was one of the few rivers in England and Wales to exceed its spawning target for salmon.

European Eel

10.4.458 The European eel is listed as critically endangered on the IUCN Red List and the global population of the species is declining (Freyhof and Brooks, 2011). The European eel is a priority species in the OSPAR list of threatened and declining species. It is also a UK BAP priority species and it is a species of principal importance for the purpose of conserving biodiversity under the NERC Act 2006.

10.4.459 European eels begin their life as eel larvae and it is thought that these larvae drift from their birthplace in the Sargasso Sea for three years across the Atlantic Ocean on ocean currents to the Severn Estuary. Here they metamorphose into 'glass eels' and subsequently develop into more pigmented 'elvers', grow larger (yellow eel) before reaching reproductive maturation.

10.4.460 The majority of upstream migration of elvers (juveniles) occurs between April and September (inclusive) and this freshwater phase is a feeding and growing stage, before they migrate out of the estuary. The peak downstream migration of adult eel takes place between September and November (EDF, 2011). Spawning takes place in late winter and spring, again assumed to be in the Sargasso Sea area.

10.4.461 Low numbers of European eel have been recorded in fyke net surveys undertaken by NRW between 2008 and 2015 off Goldcliff, to the east of the mouth of the River Usk (NRW, 2015). European eel were typically recorded during spring netting surveys.

Sea Trout

10.4.462 Sea trout generally enter the rivers of South Wales between June and September, with smaller numbers entering at other times of the year. The timing of the downstream migration of sea trout smolts is similar to that of Atlantic salmon (April to June). They differ from salmon in that they have a greater propensity to survive to undertake repeated spawnings and their marine phase is usually more coastal than salmon; which undertakes more extensive marine migrations. Sea trout is classified as Least Concern on the IUCN Red List.

Table 10.11: Summary of Migration Periods (upstream ↑ and downstream ↓) for Diadromous Species

Common Name	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Allis and twaite shad			↑	↑	↑	↑						
Allis and twaite shad (juv.)			↓	↓	↓		↓	↓	↓			
Atlantic salmon			↑	↑	↑	↑	↑	↑	↑			
Atlantic salmon (juv.)				↓	↓	↓						
River lamprey	↑		↑	↑				↑	↑	↑	↑	
River lamprey (juv.)	↓	↓	↓	↓	↓					↓	↓	↓
Sea lamprey					↑	↑	↑					
Sea lamprey (juv.)	↓									↓	↓	↓
Sea trout			↓	↓	↑	↑	↑	↑	↑			
European eel									↓	↓	↓	
European eel elvers				↑	↑	↑	↑					

10.4.463 Recognising that the migratory fish that pass through the Usk Estuary comprise the community for which the River Usk SAC is partially designated, that these fish form part of the Severn Estuary SAC population and that the European Eel is one of the reasons for designation of the Severn Estuary Ramsar Site, the community of migratory fish is considered to be of International (Very high) value.

Estuarine and Marine Fish Species

10.4.464 A number of other marine and estuarine species of fish have the potential to be present in the waters of the River Usk and River Ebbw in the vicinity of the proposed new section of motorway. However, in the absence of targeted surveys for non-migratory fish species in these rivers, the assemblage and likely species must be inferred from the numerous studies which have been conducted of the fish community in the wider Severn Estuary area.

10.4.465 Estuarine species of fish rely on the estuary for some aspect of their life-cycle and, as a consequence, are often the most vulnerable to anthropogenic factors affecting habitats and ecology of the estuary. Marine species that occur in large numbers in estuaries spend the first few years of life in the sheltered waters of the estuary where suitable food is abundant and there are fewer predators. The Severn Estuary ranks as one of the top ten estuaries in the UK for the number of marine estuarine-opportunistic species it supports (Potts and Swaby, 1993). Marine estuarine-opportunists can be present in the Severn Estuary in very large numbers at particular times of year. These include sprat, herring, whiting, bib/pouting, poor cods, bass and common goby (Bird, 2008). These species were also recorded during fyke netting surveys undertaken by NRW between 2008 and 2015 off Goldcliff, to the east of the mouth of the River Usk, and during

otter trawl surveys undertaken between 2003 and 2014 off Peterstone/Monkstone at the mouth of the River Usk. During the fyke net surveys, whiting was the most frequently recorded species, particularly in autumn surveys. Dover sole were also frequently recoded in the fyke nets (NRW, 2015). Both of these species were also recorded in high abundances from the otter trawl surveys at the mouth of the River Usk although gobies were found to numerically dominate these trawls (NRW, 2015). Additional species recorded during the NRW fyke netting/otter trawl surveys in the vicinity of the mouth of the River Usk included demersal flatfish species plaice and flounder. Small-bodied species were found to be common in the shallower coastal waters such as the five-bearded rockling and pogge.

10.4.466 A few estuarine species spend their entire life-cycle within the Severn Estuary including common goby, black goby, sand smelt and three-spined stickleback (Bird, 2008).

10.4.467 Marine species typically spend their entire life-cycle in the sea and only occasionally enter estuaries; these species therefore have a reduced likelihood of being present in the lower reaches of the rivers Usk and Ebbw. Those recorded in any notable numbers from the Severn Estuary, however, include conger eel, Norway pout, red mullet and plaice (Bird, 2008). Some elasmobranch species such as the common dogfish and the thornback ray are also frequently recorded around the coastal areas of South Wales, including the areas of the Bristol Channel and Severn Estuary around Newport.

Spawning and Nursery Grounds

10.4.468 Spawning by marine fish species generally occurs further out into the Bristol Channel, well outside the study area, with many species including whiting, sole, plaice, sprat and bass spawning in the spring. Over the summer months the fish larvae drift through the Bristol Channel inshore and up the Severn Estuary to their coastal nursery grounds in autumn or, for migratory species, further inland to the freshwaters of the River Usk and River Ebbw (Potter and Claridge, 1985). Nursery areas tend to occur in the shallower inshore areas of the Severn Estuary and for species including plaice, sole and whiting are likely to coincide with the areas around the mouth of both the River Usk and River Ebbw where these rivers enter the Severn Estuary (Coull *et al.,* 1998; Ellis *et al.,* 2010).

10.4.469 Several species of fish and elasmobranch have notable nursery areas within the study area and for many marine species, the Severn Estuary and its supporting habitats (e.g. intertidal mudflats, saltmarsh, freshwater rivers etc.) represent both a regionally, and in some cases nationally, important nursery habitat.

10.4.470 The literature cites a number of species with important nursery grounds within the Severn Estuary. These species include whiting, plaice, sole and anglerfish (Coull *et al.,* 1998; Ellis *et al*., 2010).

10.4.471 Recognising that the fish populations of the estuary are an integral part of the ecosystem for which the Severn Estuary SSSI is designated, the community of marine and estuarine fish (excluding the migratory species referred to above) is considered to be of National (High) value.

Invertebrates

10.4.472 The desk study identified a total of 79 invertebrate species records within the 1 km and 2 km search areas around the existing M4. Of these, 11 species were UK BAP priority species and listed under Section 42 of the NERC Act making them species of principal importance in Wales. One (white-letter hairstreak) was partially protected from sale under the Wildlife and Countryside Act 1981 and was recorded in woodland in the north east of the search area. A total of 65 of the invertebrates recorded were Red Data Book species and 14 were Local BAP species. Some were also locally important species.

10.4.473 A total of 74 invertebrate records were provided from within the new section of motorway search area. Of these, 12 were NERC Section 42 and UK BAP species and two butterflies; small blue and white-letter hairstreak (as above) partially protected from sale under the WCA. Small blue was recorded on land at Newport Docks on the edge of the route of the new section of motorway and on the Gwent Levels in the south west of the search area. The remaining invertebrates were Red Data Book species, Local BAP species in some of the counties within the search area and locally important species.

10.4.474 The majority of the invertebrate records were located in the western half of the survey area with an accumulation of records on the Gwent Levels. A number of records were also provided at the far eastern end of the search area around Magor Marsh and woodland in the north east of the search area.

10.4.475 Shrill carder bee was recorded frequently in the south of the survey area, particularly in the Gwent Levels. Shrill carder bee, orange footman moth and scarlet tiger month were all recorded very near to the existing M4 motorway.

10.4.476 Short-winged cone-head, speckled bush-cricket, a range of water beetles, double kidney moth and emerald damselfly were all recorded within or along the new section of motorway.

Terrestrial Invertebrates

10.4.477 In the 2014 survey undertaken by Rachel Hacking Ecology (Appendix 10.15), 289 species of terrestrial invertebrate were recorded across the whole survey area. This total only included true species, rather than genus-only records. The numbers of species by taxonomic group are shown in Table 10.12.

Table 10.12: Total Number of Invertebrate Species (Terrestrial) per Taxonomic Group

Taxonomic Group	No. of species
Diptera (true flies)	118
Coleoptera (beetles)	90
Araneae (true spiders)	26
Opiliones (harvestmen)	5
Lepidoptera (moths and butterflies)	13
Odonata (dragonflies and damselflies)	12
Hymenoptera (bees, and wasps)	6
Hemiptera (true bugs)	19
Total Number of Species	**289**

10.4.478 From the terrestrial invertebrate total, one Red Data Book (IUCN 'rare') (Wells *et al.,* 1983) species was recorded. This is the yellow-horned horsefly (*Hybomitra*

ciureai). The species has been recorded from the south and south east coasts of England. One record exists for the west; this is from 1987 when the fly was taken from Magor Marsh, south of Magor village. As far as can be determined, the record from this survey is the second for Gwent. The species was identified at Site 11, a well vegetated ditch just north of the disused laboratory site.

10.4.479 Three 'nationally notable' species of terrestrial invertebrate were recorded. These were as follows.

- A rove beetle (Staphylinidae): *Paedurus fuscipes*. This species is associated with damp habitats. A number of records already exist from the Newport area for this species. The species is designated 'Notable B' and was collected from Site 20; Old Dairy Reen, a well vegetated reen.
- A fruit-fly or picture-winged fly (Tephritidae): *Dioxyna bidentis*. This species is known from marshes and other wet areas. The larvae are often associated with the plant trifid bur-marigold. As far as can be determined, no records exist for this species of fly from the Gwent Levels. The nearest record appears to be from the Swansea area. This species was collected from Site 20; Old Dairy Reen, a well vegetated reen.
- A true fly (Muscidae): *Coenosia atra*. This species is associated with ex-industrial sites and to a lesser extent, grassland habitats. As far as can be determined, no records exist for this species from the Gwent Levels. The nearest record appears to be from the Swansea area. This species was collected at the Tata Steel site, within the open habitats present there.

10.4.480 The majority of the terrestrial invertebrate sampling points were associated with watercourses on or close to the line of the proposed new section of motorway. In addition two 'control' sites were sampled. Table 10.13 summarises the findings of the survey for each site.

Table 10.13: Summary of the Findings of the Terrestrial Invertebrate Survey

Site No.	Site name	Total species	Notable species
1	Neways Reen	53	*Cleigastra apicalis* – fly (Local) *Donacia semicuprea* – reed beetle (Local) *D. simplex* – reed beetle (Local) *D. vulgaris* – reed beetle (Local)
3	Middle Road Reen	53	*Palloptera quinquemaculata* – fly (Local) *Setisquamalonchaea fumosa*– fly (Local) *Chrysops viduatus* - Square-spot Deerfly (Local) *Donacia simplex* - reed beetle (Local)
4	Elver Pill Reen	29	*Oedemera lurida* - flower beetle (Local) *Meligethes pedicularius* - pollen beetle (Local) *Donacia simplex* - reed beetle (Local) *D. vulgaris* - reed beetle (Local) *Galerucella sagittariae* - reed beetle (Local)
5	Unnamed reen	19	*Donacia semicuprea* - reed beetle (Local) *D. simplex* - reed beetle (Local)
6	Unnamed reen	32	N/A

Site No.	Site name	Total species	Notable species
7	Tata Steel Land	78	*Coenosia atra* - muscid fly (Nationally Notable) *Amara tibialis* - ground beetle (Local) *Paedurus riparius* - the rove beetle (Local) *Chrysolina hyperici* - chrysomelid (Local) *Cryptocephalus fulvus* - chrysomelid (Local) *Mangora acalypha* - spider (Local)
11	Unnamed ditch	11	*Hybomitra ciureai* - Yellow-horned Horsefly (Red Data Book-Rare) *Prasocuris junci* - leaf beetle (Local)
20	Old Dairy Reen	21	*Dioxyna bidentis* - Tephritid fly (Nationally Notable) *Paedurus fuscipes* - rove beetle (Notable B) *Paedurus riparius* - rove beetle (Local)
28	Pond	17	*Coproica hirtula* - Sphaeroceridae fly (Rare)
31	St Bride's Brook	28	N/A
32	Unnamed ditch	24	*Paedurus riparius* - rove beetle (Local) *Tytthaspis sedecimpunctata* - 16-Spot Ladybird (Local)
33	Unnamed ditch	11	N/A
35	Semi-improved grassland	57	N/A
36	Wet woodland	36	*Leistus fulvibarbis* - ground beetle (Local) *Oedemera lurida* - flower beetle (Local)
37	Unnamed reen	28	*Agonum thoreyi* - beetle (Local) *Paedurus riparius* - beetle (Local)
40	Unnamed ditch	14	*Paedurus riparius* - rove beetle (Local) *Anthocomus rufus* - reedbed beetle (Local)
41	Disused Laboratory	77	*Sapromyza sexpunctata* – fly (Local) *Stenus solutus* - rove beetle (Local) Mangora acalypha – spider (Local)
Control Sites			
CS 1	Unnamed ditch	24	*Coenosia humilis* - muscid fly (Local)
CS 2	Unnamed reen	21	*Agonum thoreyi* - ground beetle (Local)

10.4.481 In 2015 David Gibbs, on behalf of RPS, undertook terrestrial invertebrate surveys of land within Newport Docks and Tata Steel, and a survey of shrill carder bee *Bombus sylvarum* and brown-banded carder bee *B. humilis* across those sections of the Gwent Levels along the proposed new section of motorway corridor.

10.4.482 The survey within Newport Docks (see Appendix 10.31) identified 329 species. Of these 32 (9.7%) were considered to be 'Key Species', seven of them of Red Data Book or equivalent status. This represents a good diversity for such an open site.

10.4.483 The proportion of Key Species is good, indicating an area of significant invertebrate conservation value. While many key species are known to be doing well nationally, and some have good populations in the region, others are rarely recorded or are unknown in South Wales. One species, a fly *Liriomyza intonsa,* is new for Britain.

10.4.484 Four UK BAP/Section 42 species were recorded including two important bumblebees, the brown-banded carder bee and the shrill carder bee, for which this part of South Wales is an important stronghold.

10.4.485 Both these bumblebees require a larger landscape scale habitat mosaic in order to maintain viable populations and many open habitats in and around the survey site will be important for the viability of these populations. The results of the targeted survey for these species are summarised below.

10.4.486 The survey showed that the saltmarsh beside the River Ebbw is of particular importance for invertebrates.

10.4.487 The survey within Tata Steel's land (see Appendix 10.31) recorded 378 species. Of these 31 (8.2%) were considered to be 'Key Species', nine of them of Red Data Book or equivalent status (2.4%). This is a good diversity for the habitat types present. The proportion of Key Species was good, indicating an area of significant invertebrate conservation value.

10.4.488 Of particular interest were a fly *Hydrophorus viridis* and a hoverfly *Sphaerophoria loewi*, both very rare nationally.

10.4.489 Four BAP/Section 42 species were recorded including the two important bumblebees, the brown-banded carder bee and the shrill carder bee.

10.4.490 Reens and ephemeral pools were particularly important for the rarest species found. Reedbeds and sedge beds were also important for a number of scarce species and general biodiversity. Old poplar trees were also of interest.

10.4.491 The survey for bumblebees (see Appendix 10.31) recorded 56 shrill carder bees from 16 fields/compartments and 67 brown-banded carder bees from 18 fields/compartments. This confirms the continuing importance of the Gwent Levels for these two UK BAP bumblebees. An additional 10 species of bumblebee were recorded.

10.4.492 The great majority of the populations of both target species occurred on or south of the proposed route of the new section of motorway. Although they were found across the whole of the survey area, records were noticeably clumped in areas of floral diversity and abundance. Ungrazed open areas such as the Tata Steel land seem to be important in providing a greater diversity of floral resources. Hedgerows and reens were important where pasture was improved or semi-improved.

10.4.493 The small ranunculus moth, recorded within the Tata Steel land, is the subject of a Species Action Plan in the Newport Biodiversity Action Plan. It was once widespread in southern Britain, but declined dramatically in the late 19th century and was declared extinct in 1930's. However, in recent years it has returned and is beginning to recolonize it's old distribution areas, particularly in Kent and south east England. Its first Welsh record was in 1999 in Newport. Larvae were found in the city in 2003 on a brownfield site near the docks and have subsequently been found on many brownfield sites in the area.

10.4.494 The small ranunculus is strongly associated with brownfield sites as its main larval host plant, prickly lettuce, is a ruderal species requiring disturbed ground and is often found at such sites. Brownfield sites are important for the recovery of this and other invertebrate species.

10.4.495 The objectives for this species are as follows.

- To maintain and increase the small ranunculus population of Newport through appropriate management and advice.

- To gather data on the distribution and status of small ranunculus in Newport through larvae searches and light traps.
- To raise awareness about the small ranunculus in Newport.

10.4.496 The shrill carder bee is also a Newport BAP species recognising that one of the remaining populations of this species is on the flower rich grasslands of the Gwent Levels SSSIs. The aims of the shrill carder bee action plan are as follows.

- Work with landowners to maintain and extend the areas of flower-rich grassland available to shrill carder bees, particularly focussing on linking suitable habitat together.
- Work in partnership with Gwent Wildlife Trust, Bumblebee Conservation Trust and neighbouring local authorities for the benefit of the species.
- Gather survey data of the distribution of the species.
- Ensure that planning pressures on known shrill carder bee habitat are reduced as far as possible.
- Raise awareness and understanding of the species.

10.4.497 Recognising that shrill carder bee is very restricted in its UK distribution and is one of the features for which the Gwent Levels SSSIs are designated, the population of shrill carder bee in the vicinity of the new section of motorway is of National (High) value.

10.4.498 The high proportions of other species of conservation importance indicate that the overall terrestrial invertebrate assemblage within the corridor of the new section of motorway is of Regional (Medium) value.

Aquatic Invertebrates

NRW Survey Reports

10.4.499 NRW has provided reports of invertebrate surveys of the Gwent Levels SSSIs carried out on its behalf as follows.

- Monitoring Invertebrate Features on SSSIs: Aquatic Invertebrates on Gwent Levels: Whitson SSSI, 2009. D C Boyce. CCW Regional Report No. CCW/SEW/10/1 (Boyce, 2009).
- Monitoring invertebrate features on Sites of Special Scientific Interest: aquatic invertebrates on the Gwent Levels: Redwick and Llandevenny SSSI, St Brides SSSI. DC Boyce. CCW Regional Report No. SEW/12/01 (Boyce, 2012).
- Monitoring invertebrate features on Sites of Special Scientific Interest: aquatic invertebrates on the Gwent Levels: Magor and Undy SSSI, Nash and Goldcliff SSSI, Newport Wetlands SSSI, Rumney and Peterstone SSSI. DC Boyce. CCW Regional Report No. CCW/SEW/13/3 (Boyce, 2013).

10.4.500 In the survey of the Whitson SSSI (Boyce, 2009), 90 aquatic invertebrate species were recorded during the sampling programme, with two, the water beetles *Hydaticus transversalis* and *Hydrophilus piceus,* being Red Data Book species (Wells *et al.,* 1983). A further six nationally scarce species and 16 that are thought to have a high fidelity to grazing marsh habitats were noted. Species richness in the twelve samples ranged from 20 to 43 species. The Species

Quality Index and the Habitat Quality Score were in the range from 1.19−1.47 and 1.56−9.72 respectively.

10.4.501 These figures were low compared to grazing marsh ditches sampled in other parts of southern Britain, such as the Somerset Levels. Two main causes were thought likely to contribute to the relatively low invertebrate diversity at Whitson. Firstly, many of the ditches were choked with growth of duckweeds, including the recent American colonist least duckweed *Lemna minuta*. The presence of abundant duckweed is thought to indicate a high degree of eutrophication. Dense mats of duckweed also suppress the growth of submerged beds of aquatic macrophytes, these being a very important niche for aquatic invertebrates.

10.4.502 Secondly, most of the ditches were subject to a very regular programme of clearing out, which also prevents the development of late-successional ditch habitats with diverse aquatic and emergent vegetation that supports the greatest diversity of invertebrate species.

10.4.503 In 2011, 24 grazing marsh ditches were sampled on the on the Redwick & Llandevenny and St. Brides SSSIs (Boyce, 2012). In all, 101 aquatic invertebrate species were recorded during the sampling programme, with two, the great silver water beetle *Hydrophilus piceus* and the soldierfly *Odontomyia ornata*, being Red Data Book species. A further five nationally scarce species and 17 that are thought to have a high fidelity to grazing marsh habitats were noted. Species richness in the 24 samples ranged from 21 to 41 species. The Species Quality Index and the Habitat Quality Score were in the range from 1.18-1.68 and 0-11.29 respectively.

10.4.504 As for the previous survey of the Whitson SSSI, these figures were low compared to grazing marsh ditches sampled in other parts of southern Britain, such as the Somerset Levels. The two main causes were considered to be choking of the ditches with duckweed and the regular clearing of ditches.

10.4.505 In 2012, aquatic invertebrate sampling was undertaken in grazing marsh ditches in the Magor & Undy, Nash & Goldcliff, Newport Wetlands and Rumney & Peterstone SSSIs (Boyce, 2013). Forty four main reen sections, plus five field ditches, were sampled. In all, 148 aquatic invertebrate species were recorded during the sampling programme, with three, the king diving beetle *Dytiscus dimidiatus*, the great silver water beetle *Hydrophilus piceus* and the soldierfly *Odontomyia ornata*, being Red Data Book species. A further nine nationally scarce species and 18 that are thought to have a high fidelity to grazing marsh habitats were noted. Species richness in the 46 sample stations ranged from 14 to 42 species. The Species Quality Index and the Habitat Quality Score were in the range from 1.06-1.47 and 0-11.67 respectively.

10.4.506 As for the previous surveys of the Whitson, Redwick & Llandevenny and St. Brides SSSIs these figures were low compared to grazing marsh ditches sampled in other parts of southern Britain, such as the Somerset Levels. The two main causes were considered to be choking of the ditches with duckweed and the regular clearing of ditches.

10.4.507 Table 10.14 summarises the notable species recorded within the Gwent Levels SSSIs (Boyce, 2009, 2012 and 2013).

Table 10.14: Notable Invertebrate Species Recorded in Surveys of the Gwent Levels SSSIs for CCW/NRW

Common Name	Species Name	SSSI	Status
Great silver water beetle	*Hydrophilus piceus*	Whitson SSSI Newport Wetlands SSSI Redwick and Llandevenny SSSI St Bride's SSSI	Red Data Book 3
A water beetle	*Hydaticus transversalis*	Whitson SSSI Rhymney and Peterstone SSSI Redwick and Llandevenny SSSI St Bride's SSSI	Red Data Book 3
A soldierfly	*Odontomyia ornata*	Nash and Goldcliff SSSI Newport Wetlands SSSI Redwick and Llandevenny SSSI St Bride's SSSI	Red Data Book 2
A water beetle	*Dytiscus dimidiatus*	Rhymney and Peterstone SSSI	Nationally threatened
A water beetle	*Scirtes orbicularis*	Nash and Goldcliff SSSI Rhymney and Peterstone SSSI	Nationally Scarce A
Hairy dragonfly	*Brachytron pratense*	Whitson SSSI Redwick and Llandevenny SSSI St Bride's SSSI	Nationally Scarce B
A water beetle	*Peltodytes caesus*	Whitson SSSI Magor and Undy SSSI Nash and Goldcliff SSSI Newport Wetlands SSSI Rhymney and Peterstone SSSI Redwick and Llandevenny SSSI St Bride's SSSI	Nationally Scarce B
A water beetle	*Haliplus heydeni*	Whitson SSSI Redwick and Llandevenny SSSI St Bride's SSSI	Nationally Scarce B
A water beetle	*Rhantus grapii*	Whitson SSSI St Bride's SSSI	Nationally Scarce B
A water beetle	*Rhantus suturalis*	Whitson SSSI	Nationally Scarce B
A water beetle	*Helophorus griseus*	Whitson SSSI	Nationally Scarce B
A water beetle	*Enochrus ochropterus*	Whitson SSSI Redwick and Llandevenny SSSI	Nationally Scarce B
A ground beetle	*Odacantha melanura*	Rhymney and Peterstone SSSI	Nationally Scarce B

Common Name	Species Name	SSSI	Status
A soldier beetle	*Silis ruficollis*	Rhymney and Peterstone SSSI	Nationally Scarce B
A beetle	*Bagous limosus*	Newport Wetlands SSSI	Nationally Scarce B
A water beetle	*Laccobius sinuatus*	Whitson SSSI	Nationally Scarce
A water beetle	*Agabus conspersus*	Magor and Undy SSSI	Nationally Scarce
A soldierfly	*Odontomyia tigrina*	Magor and Undy SSSI Redwick and Llandevenny SSSI St Bride's SSSI	Nationally Scarce
A soldierfly	*Stratiomys singularior*	Magor and Undy SSSI Redwick and Llandevenny SSSI	Nationally Scarce
A water beetle	*Enochrus melanocephalus*	St Bride's SSSI	Local

10.4.508 A number of the ditches included in the surveys are within the new section of motorway corridor. Information on these ditches is summarised below.

St Bride's SSSI

Ditch EA10

10.4.509 This is described as a botanically diverse ditch with a strong current. There was abundant submerged growth of Canadian pondweed and abundant floating and emergent plants of arrowhead, frogbit, water horsetail, branched bur-reed, unbranched bur-reed and common reed. The ditch margins had tall fringes of mixed fen vegetation in which some of the above species occurred along with sedges, reed canary-grass, meadowsweet and rushes amongst others. Notable invertebrate species recorded from this ditch were:

Brachytron pratense	Hairy dragonfly	Nationally Scarce B
Hydrophilus piceus	Great silver water beetle	Nationally threatened

Ditch IDB34

10.4.510 This is described as a very rich-looking ditch, despite cover of duckweed here being rather high (75-90% cover across the three sub-samples). There was much submerged growth of pondweeds and floating leaves of frogbit were also abundant. Cattle had created very wide, shallow ditch margins, which had a diverse emergent/fringing flora that includes much common water-plantain, lesser water-parsnip, branched bur-reed, common reed, sedges, reed sweet-grass and water horsetail. Notable invertebrate species recorded from this ditch were:

Brachytron pratense	Hairy dragonfly	Nationally Scarce B
Scirtes orbicularis	A water beetle	Nationally Scarce A
Silis ruficollis	A soldier beetle	Nationally Scarce B
Odontomyia tigrina	A soldierfly	Nationally Scarce

Ditch IDB35

10.4.511 This was a large, deep and steep-sided ditch. The wetland flora here was very rich, with much submerged growth of fennel and curled pondweeds, plus some water-starwort. Duckweed was frequent, but not dominant, and there was also much frogbit and also some floating rafts of alga. There were frequent emergent plants of arrowhead and occasional common water-plantain, floating sweet-grass and branched bur-reed. The banks had a tall fringe of common reed, hemlock water-dropwort, meadowsweet, rushes and purple loosestrife. Notable invertebrate species recorded from this ditch were:

Brachytron pratense	Hairy dragonfly	Nationally Scarce B

Ditch IDB37

10.4.512 This ditch ran partly through woodland, and had steep, unmanaged banks, and then through open, cattle-grazed grazing marsh. The channel had much submerged growth of Canadian pondweed, and floating leaves of frogbit and broad-leaved pondweed were also frequent. Duckweed was very scarce along

most of this ditch. There was also much alga, both floating and submerged. Emergent and fringing vegetation was quite diverse, especially in the grazed sub-samples where cattle poaching had created shallow margins. Branched bur-reed, water horsetail, rushes, common water-plantain, lesser water-parsnip and floating sweet-grass were among the species recorded in this zone. No notable invertebrate species were recorded from this ditch.

Nash and Goldcliff SSSI

Ditch IDB65

10.4.513 This ditch had abundant submerged macrophytes throughout, with rigid hornwort and fine-leaved, curled, and Canadian pondweeds being noted at the sample stations. Floating mats of small duckweeds and greater duckweed were another conspicuous feature. There were also some floating leaves of frogbit in the marginal area of the reen. The ditch margins were backed by silage and cereal fields, and did not appear to have been grazed recently. Marginal vegetation was dominated by tall emergent bands of common reed, reed sweet-grass, reed canary-grass, hemlock water-dropwort, yellow flag and large sedges. Notable invertebrate species recorded from this ditch were:

Peltodytes caesus	A water beetle	Nationally Scarce B

Ditch IDB68

10.4.514 This was a 'clean' ditch that appeared to have been cleared out quite recently, with little in the way of emergent vegetation. Small duckweeds and greater duckweed were patchily abundant on the surface, along with frequent floating leaves of frogbit. Submerged mats of fine-leaved, curled and Canadian pondweeds were also locally abundant. The banks were quite steep-sided with little evidence of poaching by animals and were clothed in tall sedges and yellow flag. Notable invertebrate species recorded from this ditch were:

Odontomyia ornata	A soldierfly	Red Data Book 2

Ditch IDB77

10.4.515 For the most part this ditch had an open water column, though beds of lesser pondweed, fine-leaved and curled pondweeds were locally abundant. Small duckweeds comprised the bulk of cover of duckweed, though greater and ivy-leaved duckweeds were also recorded. Areas of shallow, poached margins had a low cover of emergent floating sweet-grass, reed sweet-grass, rushes, large sedges, lesser water-parsnip and some water-plantain. Ungrazed banks had more steeply profiled banks and taller stands of the same species. Notable invertebrate species recorded from this ditch were:

Scirtes orbicularis	A water beetle	Nationally Scarce A

Redwick and Llandevenny SSSI

Ditch EA20

10.4.516 This was a high quality ditch, with much submerged growth of macrophytes (mostly fennel pondweed, curled pondweed, rigid hornwort and ivy-leaved duckweed). There was generally high, but not completely dominant cover of floating duckweed, plus frequent floating leaves of frogbit. Much of this ditch was

cattle grazed, with shallow, poached margins and a sparse fringe of marginal vegetation that included soft rush, sedges, common spike-rush, lesser water-parsnip, branched bur-reed, lesser spearwort and hemlock water-dropwort. Fenced sections had a taller strip of emergent and fringing vegetation including many of the above species, plus reed sweet-grass, yellow flag and great water dock. Notable invertebrate species recorded from this ditch were:

Hydaticus transversalis	A water beetle	Red Data Book 3
Hydrophilus piceus	Great silver water beetle	Red Data Book 3
Bagous alismatis	A beetle	Nationally Scarce B
Odontomyia tigrina	A soldierfly	Nationally Scarce

Ditch IDB53

This ditch appeared to be of generally high quality, having much growth of submerged fennel and curled pondweeds, plus low cover of duckweed. There was also a little floating amphibious bistort. Cattle trampling had produced shallow marginal areas with emergent water horsetail, floating sweet-grass and reed sweet-grass, and the latter species plus common reed, hemlock water-dropwort and yellow flag also occurred as tall fringing fen where stock did not have access. Notable invertebrate species recorded from this ditch were:

Odontomyia tigrina	A soldierfly	Nationally Scarce

Arup 2014 Survey Report

10.4.517 In the 2014 survey undertaken by Rachel Hacking Ecology (Appendix 10.15), 130 species of aquatic invertebrate were recorded across the whole survey area. The numbers of species by taxonomic group are shown in Table 10.15.

Table 10.15: Total Number of Invertebrate Species (Aquatic) per Taxonomic Group

Taxonomic Group	No. of species
Tricladida (flatworms)	3
Hirudinea (leeches)	6
Mollusca (snails and mussels)	25
Malacostraca (shrimps and hoglice)	3
Ephemeroptera (mayflies)	2
Plecoptera (stoneflies)	0
Odonata (dragonflies and damselflies)	11
Hemiptera (true bugs)	16
Coleoptera (beetles)	57
Megaloptera (alderflies)	1
Trichoptera (caddisflies)	4
Lepidoptera (butterflies and moths)	2
Total	**130**

10.4.518 The majority of the aquatic invertebrate sampling points were on or close to the line of the proposed new section of motorway. In addition four ‘control’ sites were sampled. Table 10.16 summarises the findings of the survey for each site.

Table 10.16: Summary of the Findings of the Aquatic Invertebrate Survey

Site No.	Site name	Total species	Notable species
1	Neways Reen	46	Hydroporus tessellatus – beetle (Local) Noterus clavicornis – beetle (Local)
2	Unnamed ditch	15	Rhantus grapii – beetle (Local) Hydroporus tessellatus – beetle (Local)
3	Middle Road Reen	37	Hydrophilus piceus – Great silver water beetle (RDB-NT) Hydaticus transversalis – beetle (Nationally scarce) Noterus clavicornis – beetle (Local)
4	Elver Pill Reen	40	Hydrophilus piceus – Great silver water beetle (RDB-NT) Hygrotus impressopunctatus – beetle (Local) Noterus clavicornis – beetle (Local)
5	Unnamed reen	43	Glossiphonia heteroclite – leech (Local) Anodonta cygnea – Swan mussel (Local) Noterus clavicornis – beetle (Local)
6	Unnamed reen	29	Haliplus immaculatus – beetle (Local) Noterus clavicornis – beetle (Local)
8	Unnamed ditch	21	Hydroporus tessellatus – beetle (Local) Laccobius minutus – beetle (Local)
9	Black Wall	20	Hippeutis complanatus – snail (Local) Hydroporus tessellatus – beetle (Local)
10	Unnamed reen	7	N/A
11	Unnamed ditch	28	Aplexa hypnorum – snail (Local) Liopterus haemorrhoidalis – beetle (Local) Hydroporus tessellatus– beetle (Local) Hygrotus impressopunctatus– beetle (Local) Enochrus coarctatus– beetle (Local) Laccobius minutus. – beetle (Local)
12	Unnamed ditch	10	Hydroporus tessellatus– beetle (Local)
13	Unnamed ditch	10	N/A
14	Unnamed ditch	13	Hydroporus tessellatus– beetle (Local)
15	Julian's Reen	14	Noterus clavicornis – beetle (Local)
16	Unnamed reen	22	Hydaticus transversalis – beetle (Nationally scarce)
17	Unnamed ditch	26	Hydaticus transversalis – beetle (Nationally scarce) Liopterus haemorrhoidalis – beetle (Local) Laccobius minutus – beetle (Local)
18	Unnamed ditch	19	Hydaticus transversalis – beetle (Nationally scarce)
19	Unnamed ditch	14	Liopterus haemorrhoidalis - beetle (Local)
20	Old Dairy Reen	31	Hydaticus transversalis – beetle (Nationally scarce)
21	Percoed Reen	16	Noterus clavicornis – beetle (Local)
22	Unnamed ditch	7	N/A
23	Unnamed ditch	5	N/A
24	Unnamed ditch	11	N/A
25	Pond	23	Haliplus immaculatus – beetle (Local) Noterus clavicornis – beetle (Local) Rhantus grapii – beetle (Local) Laccobius minutus – beetle (Local)
26	Stream	8	Liopterushaemorrhoidalis – beetle (Local) Hygrotus impressopunctatus – beetle (Local)

Site No.	Site name	Total species	Notable species
27	Stream	7	N/A
28	Pond	31	Peltodytes caesus – beetle (Nationally Scarce)
29	Pond	7	N/A
30	Stream	4	N/A
31	St Bride's Brook	27	Agabus didymus - beetle (Local)
32	Unnamed ditch	14	Noterus clavicornis - beetle (Local) Anisosticta 19-punctata - Water Ladybird (Local)
33	Unnamed ditch	24	Scirtes hemisphaericus - beetle (Local)
34	Unnamed ditch	19	N/A
37	Unnamed reen	29	Notonecta maculata – water bug (Local) Hygrobia hermanni - beetle (Local)
38	Unnamed ditch	9	Suphrodytes dorsalis - beetle (Local)
39	Unnamed ditch	11	N/A
40	Unnamed ditch	22	N/A
Control Sites			
CS 1	Unnamed ditch	22	N/A
CS 2	Unnamed reen	19	Notonecta maculata - water bug (Local)
CS 3	Unnamed ditch	22	Erpobdella testacea - leech (Local)
CS 4	Unnamed reen	22	N/A

10.4.519 From the aquatic invertebrate total, one Red Data Book species (IUCN Near Threatened) was recorded. This was the Great Silver Water Beetle *Hydophilus piceus* recorded at Site 3 - Middle Road Reen and Site 4 - Elver Pill Reen, within the Tata Steel site. Both sites were well vegetated reens. Both the adult and the egg cocoon of *H. piceus* were observed.

10.4.520 One Nationally Scarce species was recorded. This was the water beetle *Hydaticus transversalis* recorded from five sites; Site 3, Site 16, Site 17, Site 18 and Site 20. All were well vegetated ditches or reens.

10.4.521 The Trunk Road Estate BAP includes a species action plan for aquatic species including:

- White-clawed crayfish and other invertebrates.

10.4.522 The species specifically identified are white-clawed crayfish and freshwater pearl mussel, neither of which is relevant to the new section of motorway as there is no suitable habitat.

10.4.523 The requirement for further survey of aquatic invertebrates was discussed with NRW and it was agreed that this was not necessary. For the purposes of this ES it is assumed that all reens and ditches within the various SSSI boundaries are capable of supporting the individually qualifying and invertebrate assemblage of each specific SSSI. On the basis that the invertebrate community of the reens and ditches is a key feature of the Gwent Levels SSSI designations it is considered to be of National (High) value.

Invasive Alien Species

10.4.524 Invasive alien species are non-native species with the potential to have considerable adverse impacts on the environment and/or our native species,

primarily due to their highly competitive nature. Only a minority of non-native species are invasive.

10.4.525 Information on the locations of invasive alien species was collected through desk study and site surveys, in particular the desk study (Appendix 10.17), the 2014 Arup Extended Phase 1 Habitat Survey (Appendix 10.2), the 2015 RPS Extended Phase 1 Habitat Survey (Appendix 10.19) and the 2015 Aquatic Macrophyte Survey (Appendix 10.30). The following species were recorded during the surveys and the locations of records are shown on Figure 10.9.

- Japanese knotweed (*Fallopia japonica*).
- Himalayan balsam (Impatiens glandulifera).
- Giant hogweed (Heracleum mantegazzianum).
- Montbretia (Crocosmia x crocosmifolia).
- Cotoneaster species (*Cotoneaster* spp.).
- New Zealand pygmyweed (*Crassula helmsii*).
- Nuttall's waterweed (*Elodea nuttallii*).
- Floating pennywort (Hydrocotyle ranunculoides).
- Least duckweed (*Lemna minuta).*
- Canadian pondweed (*Elodea Canadensis*).
- Water fern (Azolla filiculoides).
- American mink (*Neovison vison*).

Japanese Knotweed

10.4.526 Japanese knotweed is a tall herbaceous perennial plant with bamboo like stems, commonly found in urban areas, particularly on waste land, railways, road sides and river banks. It often grows into dense thickets and has characteristic leaves and stems, persistence of last year's dead canes and distinctive rhizome. The plant out competes native flora, contributing to river bank erosion and increasing the likelihood of flooding.

10.4.527 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.528 Within the 2014 Arup and 2015 RPS Phase 1 habitat surveys, Japanese knotweed was commonly recorded within the study area and several stands of this plant were observed in the west of the study area along the A48 in Castleton, at Cefn Llogell, at New Dairy Farm and within the Newport Docks. It was also recorded along the River Usk, south of the Tata land and around Junction 23A of the existing M4. An area of Japanese knotweed is also present within the Magor Brewery.

Himalayan Balsam

10.4.529 Himalayan balsam is found mostly on river banks and in damp woodland, but it can grow in other damp habitats. It is a tall, annual herb with explosive seed heads. It is easy to identify as a mature plant with its pink-purple flowers, fleshy

stem and characteristic leaves. It spreads solely by seeds, which are small and easily carried by wind or water.

10.4.530 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.531 Himalayan balsam was recorded along road verges, watercourses and within areas of industrial land. Particularly large amounts were recorded along the A48 at Castleton and within woodland at Berryhill Farm. There are also considerable amounts of Himalayan balsam within the Tata Steelworks lagoons area.

Giant Hogweed

10.4.532 Giant hogweed is widespread, most commonly found on river banks. It is easy to identify when fully grown by its height and the size of the leaves and flowers. It spreads solely by seeds, through wind dispersal and in watercourses and by deliberate planting.

10.4.533 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.534 Giant Hogweed has been recorded along the existing M4 road verge at Caldicot.

Montbretia

10.4.535 Montbretia is widely grown in gardens and is found naturalised in hedgerows, road verges, banks of lakes and rivers, beside woods and waste land. It is recognised when in flower by the distinct shape and colour of the flower heads.

10.4.536 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.537 It was recorded in the 2014 desk study but specific locations were not given.

Cotoneaster Species

10.4.538 This is a large group of small trees and prostrate shrubs that can be either evergreen or deciduous. They are becoming increasingly naturalised though birds which eat the small red berries and spread the seed.

10.4.539 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.540 There are desk study records of Cotoneaster within residential gardens at least 500 m from the western end of the new section of motorway. There were no other records.

New Zealand Pygmyweed

10.4.541 New Zealand pygmyweed is found in aquatic habitats up to 3 m deep in still or slow flowing waterbodies or around pond or lake margins. It can be submerged,

emergent and terrestrial, forming dense mats which can impede drainage, causing flooding and it displaces other aquatic species.

10.4.542 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.543 Within the 2014 Arup Phase 1 habitat survey, New Zealand pygmyweed was recorded covering a pond at the Parc Gold Club, Coedkernew, and within a ditch south of Duffryn.

Nuttall's Waterweed

10.4.544 Nuttall's waterweed is an aquatic submerged plant, apart from tiny white flowers borne on very long thread-like stalks just above the water surface, which grows up to 3 m in length. It can be found in still or slow flowing, shallow or deep water.

10.4.545 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.546 Within the 2014 Phase 1 habitat survey, Nuttall's waterweed was found at two locations within the Gwent Levels; to the south of the Tata Reedbeds and within the reen that runs parallel with North Row.

10.4.547 In 2015 it was recorded during the aquatic macrophyte survey. Locations include south of Duffryn, and areas within Tata Steel land, Llandevenny and Caldicot Moor.

Floating Pennywort

10.4.548 Floating Pennywort is mainly established from discarded plants from garden ponds. It spreads rapidly and can grow up to 20 cm per day, quickly dominating a waterbody by forming thick mats and impeding water flow and outcompeting native species by blocking out light and causing deoxygenation.

10.4.549 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.550 The 2014 Arup Phase 1 habitat survey recorded floating pennywort within Sea Wall Reen.

Least Duckweed

10.4.551 Least duckweed is a floating aquatic plant found on the surface of lakes, ponds, slow flowing rivers and ditches. It can form a dense mat over the water surface preventing light reaching the water column below and so shading out submerged vegetation. It is shade tolerant.

10.4.552 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.553 In 2015 it was recorded during the aquatic macrophyte survey, east of Coedkernew, around the Tatton farm area, the Tata Steel land and Llandevenny.

Canadian Pondweed

10.4.554 Canadian pondweed is an aquatic, submerged plant, apart from tiny white flowers borne on very long thread-like stalks just above the water surface, and grows up to 3 m in length. It is perennial and is only reproduced. It is found in still or slow flowing, shallow or deep water.

10.4.555 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.556 In 2015 it was recorded during the aquatic macrophyte survey in Llandevenny.

Water Fern

10.4.557 Water fern is a small free-floating water plant that forms dense mats, and is found in still and slow flowing waterbodies. It out competes native species by forming a dense covering on the surface of the water, blocking out light, causing deoxygenation.

10.4.558 It is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to plant or otherwise cause this species to grown in the wild.

10.4.559 In 2015 it was recorded during the aquatic macrophyte survey north of New Dairy Farm and within and south of the Tata Steel land.

Mink

10.4.560 Mink is found in aquatic habitats, including coastal, but mainly rivers and lakes. It is established throughout the UK and has a significant impact on native wildlife, especially on water voles, sea birds, domestic fowl and fish which it predates.

10.4.561 American mink is listed under Schedule 9 to the Wildlife and Countryside Act 1981 with respect to England, Wales and Scotland. As such, it is an offence to release or allow the escape of this species into the wild.

10.4.562 Due to the severity of impact mink have on water vole populations, the Gwent Wildlife Trust undertakes a mink control programme in the Gwent Levels as part of their Gwent Levels Water Vole Project.

10.4.563 The 2014 Phase 1 habitat survey recorded potential mink tar spots and recent fresh spraint along Rush Wall track in the Gwent Levels.

Biosecurity

10.4.564 As explained in Section 10.5, in order to minimise the potential impact of invasive species, biosecurity measures designed to manage and control the spread of the species would be set in place during construction.

Summary Evaluation of Ecological Baseline

10.4.565 It is impractical for an assessment of the ecological effects of a development to consider every species and habitat that may be affected; instead it should focus on ‘Valued Ecological Receptors’ (VERs). These are sites, habitats and species that are valued in some way, and could be affected by the proposed

development; other sites, habitats and species may occur on or in the vicinity of the site of the proposed development but do not need to be considered because there is no potential for them to be affected significantly.

10.4.566 Taking into account the desk study and survey work undertaken, Table 10.17 summarises the VERs identified for Scheme.

Table 10.17: Valued Ecological Receptors

VER	Value
Statutory Designated Sites	
River Usk SAC	International (Very high)
Severn Estuary SAC	International (Very high)
Severn Estuary SPA	International (Very high)
Severn Estuary Ramsar Site	International (Very high)
Wye Valley and Forest of Dean Bat Sites SAC	International (Very high)
River Usk (Lower Usk) SSSI	National (High)
Severn Estuary SSSI	National (High)
Gwent Levels SSSIs (see individual SSSIs below)	
Gwent Levels–Rumney and Peterstone SSSI	National (High)
Gwent Levels-St Bride's SSSI	National (High)
Gwent Levels-Nash and Goldcliff SSSI	National (High)
Gwent Levels-Whitson SSSI	National (High)
Gwent Levels-Redwick and Llandevenny SSSI	National (High)
Gwent Levels–Magor and Undy SSSI	National (High)
Newport Wetlands SSSI and National Nature Reserve (NNR)	National (High)
Magor Marsh SSSI	National (High)
Mwyngloddfa Mynydd-Bach SSSI	National (High)
Wye Valley Lesser Horseshoe Bat SSSI.	National (High)
Rogiet Meadow SSSI	National (High)
Penhow Woodlands SSSI and NNR	National (High)
Non- Statutory Designated Sites	
Pant-Rhiw-Goch Wood SINC	County (Medium)
Coal Pit Lane Pond SINC	County (Medium)
White Gates SINC	County (Medium)
Celtic Springs SINC	County (Medium)
LG Duffryn Site 1 (South Lake Drive) SINC	County (Medium)
LG Duffryn Site 2 SINC	County (Medium)
Duffryn Pond SINC	County (Medium)
Afon Ebbw River SINC	County (Medium)
Marshall's SINC	County (Medium)
Solutia Site SINC	County (Medium)
Alpha Steel Site SINC	County (Medium)
Spencer Works 3 SINC	County (Medium)
Elver Pill Reen Grassland & Pond SINC	County (Medium)
Greenmoor Pool SINC	County (Medium)
Wilcrick Fort West SINC	County (Medium)
Upper Cottage Pond SINC	County (Medium)
Bowkett Field, Barecroft SINC	County (Medium)
Barecroft Fields SINC	County (Medium)
Land at Barecroft Common SINC	County (Medium)
Bluehouse Farm SINC	County (Medium)
Blackwall Lane Field SINC	County (Medium)
Grange Road SINC	County (Medium)
Upper Grange Farm Field SINC	County (Medium)
Grange Wood & The Larches SINC	County (Medium)

VER	Value
Bridewell Common Field SINC	County (Medium)
Wood West of Common-y-Coed SINC	County (Medium)
Breezy Bank to Rockfield Farm SINC	County (Medium)
Nature Reserves	
Newport Wetlands Reserve (RSPB) (see above)	National (High)
Magor Marsh (Gwent Wildlife Trust) (see above)	National (High)
Great Traston Meadows (Gwent Wildlife Trust)	County (Medium)
Habitats (UK BAP Habitat, S42 Priority Habitat)	
Lowland mixed deciduous woodland (including wet woodland)	Plantations: District (Low) Semi-natural woodland: County (Medium)
Coastal and floodplain grazing marsh	National (High)
Lowland Meadow	District (Low) Species-rich: County (Medium)
Reedbeds	County (Medium)
Rivers	Usk: National (High) Ebbw: County (Medium)
Coastal saltmarsh	Usk: National (High) Ebbw: County (Medium)
Intertidal mudflats	Usk: National (High) Ebbw: County (Medium)
Subtidal Benthic Habitat	Usk: National (High) Ebbw: County (Medium)
Ponds	County (Medium)
Eutrophic Standing Waters (reens and ditches)	National (High)
Hedgerows	County (Medium)
Open mosaic habitats on previously developed land	County (Medium)
Species (flora)	
Assemblage of wet grassland plants	County (Medium)
Aquatic macrophytes	National (High)
Species (fauna)	
Otter European Protected Species, WCA Protected UK BAP, Section 42 Species	National (High)
Dormouse European Protected Species, WCA Protected UK BAP, Section 42 Species	County (Medium)
Bats European Protected Species, WCA Protected UK BAP (some), Section 42 Species (some)	Regional (Medium)
Water vole WCA Protected Species, UK BAP, Section 42 Species	County (Medium)
Badger Protection of Badgers Act	District (Low)
Hedgehog UK BAP, Section 42 Species	District (Low)
Reptiles WCA (partial protection), UK BAP, Section 42 Species	Grass snake: County (Medium) Other reptiles: District (Low)
Great crested newt European Protected Species, WCA, UK BAP, Section 42 Species WCA Partial Protection, Section 42 Species (Common toad)	County (Medium)

VER	Value
Other amphibians	District (Low)
Breeding birds	Severn Estuary SPA/Ramsar site species: National (High) Cetti's Warbler: (National (High) Barn Owl: County (Medium) Other species: District (Low)
Wintering birds	Severn Estuary SPA/Ramsar site species: National (High) Other species: District (Low)
Freshwater fish assemblage (reens and rivers)	County (Medium)
Freshwater fish (River Usk)	National (High)
European eel	International (Very high)
Migratory Fish Sea lamprey (Annex II, OSPAR, UK BAP, Section 42 Species) River lamprey (Annex II & V, UK BAP, Section 42 Species) Twaite shad (Annex II & V, UK BAP, Section 42 Species) Allis shad (Annex II & V, OSPAR, UK BAP, Section 42 Species) Atlantic salmon (Annex II & V, OSPAR, UK BAP, Section 42 Species) European eel (OSPAR, UK BAP, Section 42 Species) Sea trout (UK BAP, Section 42 Species)	International (Very high)
Estuarine fish assemblage	National (High)
Shrill carder bee	National (High)
Other terrestrial invertebrates	Regional (Medium)
Freshwater Aquatic invertebrates	National (High)

Ecological Units

10.4.567 For the purposes of this assessment the designated sites and nature reserves are considered in their own right and the other VERs are grouped together under Ecological Units based on the habitats and species present that would be affected in similar ways.

10.4.568 The Ecological Units and their component VERs are as follows.

- Rivers (Usk and Ebbw)
  - Rivers
  - Sub-tidal benthic habitat
  - Intertidal mudflats
  - Coastal saltmarsh

  - Migratory fish
  - Estuarine migratory fish assemblage
- Reens, ditches, reedbeds and ponds
  - Eutrophic standing waters
  - Ponds
  - Reedbeds
  - Aquatic macrophytes
  - Otter
  - Water vole
  - Grass snake
  - Great crested newt and other amphibians
  - Freshwater fish assemblage
  - Freshwater invertebrates
- Grazing Marsh
  - Coastal and floodplain grazing marsh
  - Shrill Carder bee
  - Wet grassland plants
- Farmland
  - Lowland mixed deciduous woodland
  - Wet woodland
  - Hedgerows
  - Lowland meadow
  - Dormouse
  - Badger
  - Hedgehog
- Industrial land
  - Open mosaic habitats on previously developed land
  - Reptiles (Common lizard, slow worm)
  - Terrestrial invertebrates
- Bats
- Breeding Birds
- Wintering Birds

Future Baseline Conditions

10.4.569 There is the potential for changes in the baseline conditions in the medium to long term as a result of climate change. The Climate Change Risk Assessment

for Wales (Welsh Government and Defra, 2012) identified the following main potential threats and opportunities for the natural environment as a result of climate change:

- reduction in soil moisture and lower river flows, and an increase in the frequency and magnitude of droughts;
- changes in soil organic carbon, although the ways in which it might be affected are not adequately understood at present;
- changes in climate space and species migration patterns, which could result in significant changes to biodiversity;
- increases in pests and diseases;
- changes to coastal and estuarine habitats and species, including a reduction in intertidal area; and
- changes to the marine environment, including an increase in disease hosts and pathogens, harmful algal blooms and invasive species. The effects of ocean acidification include adverse impacts on shellfish.

10.4.570 The Terrestrial Biodiversity Climate Change Impacts Report Card 2012 -13 (Living With Environmental Change (LWEC) Partnership, 2013) provides qualitative assessments of likely biodiversity change that indicate a direction of travel rather than quantitative predictions. Whilst climate models project changes in temperature with reasonable confidence, the complexities of ecological responses and the interactions with other non-climate pressures mean that there is a large range of possible future outcomes. This is compounded for other climate variables, such as rainfall, where there is less certainty in future projections.

10.4.571 Observations and qualitative predictions for habitats which occur in the area of the Scheme include the following.

Grasslands

- Increasing temperatures have promoted earlier spring greening of grasslands and a longer growing season.
- Reduced summer rainfall and increased evaporation and transpiration could change the species composition of plant communities in wet lowland and floodplain meadows.

Wetlands

- Periods of low rainfall have hampered the management of lowland fens.
- Reduced precipitation in summer months may adversely affect wetland habitats, with lowland fens particularly likely to be under increasing threat in southeast England.
- Drying out of wetland habitats may have major impacts on migratory birds, many of which are dependent on these areas at some point in their life cycle.

Woodland

- Leafing has advanced by 2–3 weeks since the 1950s in response to increased temperatures and this may be having a negative impact on woodland flora, particularly spring-flowering species.
- Pests and diseases (both those that are currently present in the UK and those that may be introduced) represent a major threat to woodlands. These threats may be increased by interactions with the direct effects of climate change on tree function.
- Ground flora in deciduous woodlands may change due to earlier leafing of the tree canopy as a result of rising spring temperatures.

Coastal and intertidal habitats

- Losses of saltmarsh have been substantial (e.g. 50% of saltmarsh was lost along the south coast of England between 1971 and 2001); sea level rise combined with hard sea defences ('coastal squeeze') is a major contributing factor to this loss.
- Increased air and sea surface temperatures have resulted in changes in the range sizes and distribution of a number of coastal animals. Warmer water species are shifting northwards (e.g. the molluscs *Osilinus lineatus* and *Gibba umbilicalis*).
- Where southern and northern species with similar niches occur, there has been a relative increase in abundance of the southern species. *Coelopa piipes*, a coastal strandline fly with a southern distribution, has expanded its UK range northwards and become more abundant at the expense of the previously dominant northerly species *C. frigida*.
- Warmer temperatures have resulted in changes in the timings of lifecycle events of a range of species, with the rates of change observed in marine species being greater than those observed in terrestrial and freshwater species. Warmer sea temperatures have advanced the timing of spawning of the intertidal bivalve *Macoma balthica*, resulting in a mismatch in timing between the bivalve and the phytoplankton it feeds on.
- Projected rises in sea level will have significant impacts by accelerating the natural erosion of coastal and intertidal habitats, and changing the pace and nature of natural geomorphological processes. Soft cliffs and the vegetation that grows on them will be particularly affected, especially in the south and east of England, where sea level rise will be the greatest.
- Coastal species and habitats will be subject to further coastal squeeze where coastal defences are maintained or enhanced, or hard infrastructure exists, preventing natural habitats rolling back inland.
- Projected future losses in the extent of saltmarshes and mudflats will have significant impacts on overwintering bird populations and invertebrates.
- Rising sea levels and coastal squeeze will result in conflict between the need to maintain intertidal and coastal habitats (such as dune systems) by allowing the natural movement of coastlines and through managed realignment and the need to protect valuable inland coastal habitats, such as grazing marsh and saline lagoons.

- Coastal grazing marshes, raised bogs and saline lagoons are all threatened by increases in salinity due to increased inundation of sea water during storm tides and flooding. This will ultimately cause their transformation into saltmarsh or other intertidal habitat.
- Coastal freshwater habitats including grazing marsh and lowland raised bog, which account for 3.5% of the total area of English Sites of SSSIs, are at risk from inundation by sea water.

10.4.572 The potential effects of these main potential effects of climate change on the future ecological baseline should be considered recognising that ecosystems are complex and are affected by a wide range of factors, and that there are limited data and modelling capability.

10.4.573 In particular coastal and floodplain grazing marsh is dependent on periodic inundation and high water levels, which means that it is sensitive to the projected changes in patterns of rainfall and extreme events such as drought and flooding. Coastal grazing marsh is at additional risk from sea level rise, leading to increased inundation, potential coastal erosion, and coastal squeeze, with freshwater sites adjacent to the coast sensitive to saline intrusion. Coastal grazing marsh is also vulnerable to human responses to sea level rise, including losing space to intertidal habitats following managed realignment schemes. As coastal and floodplain grazing marshes are maintained by grazing, climate change driven changes to the economics of grazing systems may also have a significant impact (Natural England, 2014).

10.4.574 As explained in Chapter 16: Road Drainage and the Water Environment and the Flood Consequences Assessment (Appendix 16.1), Welsh Government is committed to the policy of maintaining sea defences to the Gwent Levels through the Severn Estuary Shoreline Management Plan. NRW's proposed flood defence improvements will provide the required level of protection up to 2030. Continued improvements to sea defences consistent with Welsh Government policy to 'Hold the Line' and in line with the Severn Estuary Flood Risk Management Strategy (SEFRMS) (Environment Agency, 2014) would be required beyond 2030. The Flood Consequences Assessment states that it is considered inconceivable that future improvement to the coastal defences within the Gwent Levels will not be implemented since some 25,000 properties and businesses, together with strategic infrastructure such as power stations and transmission lines, regional transport routes and agricultural land would then be at risk of flooding.

10.4.575 Based on this strategy to maintain the current line of defence for the Gwent Levels, the current extent of the grazing marshes would be maintained, but it is likely that there would be further loss of intertidal habitats through 'coastal squeeze'. This could lead to changes in the extent of saltmarsh in particular around the Severn Estuary. As well as the effects of loss of habitat within the Severn Estuary SAC and Ramsar site *per se*, this could also result in the loss of high tide roosting sites for wintering bird species and assemblages of the Severn Estuary SPA and Ramsar Site. Birds may then rely more on fields on the landward side of the sea defences for roosting. It is likely that fields close to the sea wall would be most favoured. The presence of the new section of motorway would not affect the availability of such roosting sites.

10.4.576 Since water levels within the levels are artificially controlled, this provides a degree of buffering against changes in climate.

10.4.577 Whilst there may be some changes in the longer term, particularly relating to the extent of intertidal habitats, land management, particularly control of water levels and grazing management is likely to have a greater influence on biodiversity over much of the study area within the timescale of construction and opening of the new section of motorway than climate change.

10.5 Ecological Mitigation and Monitoring

10.5.1 Mitigation has been considered as an intrinsic and iterative part of the Scheme development and assessment process informed by consultation with stakeholders as required by IAN 125/15.

10.5.2 The Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 5 (HA 205/08) explains at paragraph 1.42 that:

'The iterative assessment and design processes should seek to incorporate measures to avoid or reduce the significant environmental effect following a hierarchical system, where avoidance is always the first mitigation measure to be considered:

a) Avoidance – consider and incorporate measures to prevent the effect (for example, consider alternative design options or phase the project to avoid environmentally sensitive periods).

b) Reduction – where avoidance is not possible, then methods to lessen the effect should be considered and incorporated into the project design. Consultation with the Overseeing Organisation will determine whether any remaining 'residual' effect is considered to be environmentally acceptable.

c) Remediation – where it is not possible to avoid or reduce a significant adverse effect, then measures to offset the effect should be considered.'

10.5.3 Following this guidance the mitigation measures relevant to this assessment of the ecological effects of the Scheme are outlined in this section. As set out in Chapter 2, the specific ecological mitigation measures incorporated into the Scheme design, together with other proposed mitigation (such as construction good practice) are indicated in the lists below. In assessing the impacts of the Scheme, these are assumed to be in place as intrinsic elements of the Scheme. For the other additional mitigation measures identified, the impacts are first assessed in their absence, and then with them in place.

10.5.4 A significant element of such additional mitigation is the SSSI Mitigation Strategy (see Appendix 10.35), the aim of which is to provide mitigation for the loss of coastal grazing marsh habitat as a result of the Scheme and, where practicable, to ecologically enhance land within the Gwent Levels SSSIs. As explained in the strategy, the total permanent loss of grazing marsh habitat as a result of the Scheme would be some 60.7 hectares (ha). A further 20.7 ha would be temporarily affected. Three mitigation areas have been identified as being of potential value with regard to the aims of the mitigation strategy: Maerdy Farm, Tatton Farm and Caldicot Moor. The total area of the land identified within these three areas is some 154 ha. The actual extent of this land that would be required to provide mitigation is to be agreed with NRW, who have indicated that at least an equivalent area of land to that which would be lost would be required. The overall total included in the three areas is considered to be sufficient.

10.5.5 For the purposes of the initial assessment it is assumed that the Scheme would include standard measures to control pollution during construction and that these would be set out in a Construction Environmental Management Plan (CEMP) following the principles set out in the Pre-CEMP (Appendix 3.2). This includes the measures set out in the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2) and the Outline Ground and Surface Water Management Plan (Annex G to Appendix 3.2).

10.5.6 An Environmental Liaison Group would be established for the Scheme that would consist of key stakeholders including NRW. The Group would meet at regular intervals throughout the construction period to review progress of the Scheme and its construction, and to focus on specific environmental issues as required.

10.5.7 As explained in the Pre-CEMP, an Environmental Co-ordinator (ECO) would be responsible for the interface between the environmental specialists and engineers. The ECO would have primary responsibility for managing environmental issues through the construction and post-construction monitoring phases and for obtaining relevant licences and consents.

10.5.8 The Environmental Clerk of Works (ECOW) would support the ECO during construction and aftercare. The ECOW would be the site representative for the ECO and would be responsible for overseeing construction activities to ensure all environmental commitments are met and compliance with the conditions of all licences and permits. The ECOW would be based on site full time and would have the authority to direct members of the contractor's site staff on environmental issues.

10.5.9 The mitigation measures described below would in most cases be located within land included in the Draft Orders for the Scheme. Where this is not the case, and delivery would be by agreement, this is indicated.

Avoidance

10.5.10 Measures to avoid adverse effects which are intrinsic to the design include the following.

- No construction in the wetted channels of the Rivers Usk and Ebbw (defined as the channel below Mean High Water as explained in Chapter 2: Scheme Description.
- Minimise land take within the Gwent Levels SSSIs and, where practical, avoid land take to the south of the line of the new motorway.

Reduction

10.5.11 Measures to reduce adverse effects include the following.

Mitigation Integral to the Scheme (Embedded Mitigation)

- Provision of water treatment areas to control the volume and quality of water discharged to the reen system.
- Maintaining all existing reen connections across the line of the new section of motorway.
- Provision of permanent mammal fencing along the new section of motorway.

- Avoidance of lighting other than at junctions and the river crossings.

Additional Mitigation

- Design of lighting of the River Usk and River Ebbw crossings to avoid lighting of the river channels and banks.
- Minimise light spill through lighting design.
- Provision of mammal crossings at suitable locations across the line of the new section of motorway.
- Provision of mammal tunnels adjacent to all reen culverts.
- Design of planting to guide bats to culverts.
- Provision of eel passes on all new sluices.
- Use of plant material from existing reens and ditches to encourage colonisation of new reens and ditches by aquatic macrophytes.

Offsetting

10.5.12 Measures to offset adverse effects include the following.

Mitigation Integral to the Scheme (Embedded Mitigation)

- Replacement of reens at a ratio of greater than 1:1.
- Replacement of field ditches at a ratio of greater than 1:1
- Landscape/habitat provision shown on the Environmental Masterplan (EMP) (Figure 2.6).
- Replacement of saltmarsh.

Additional Mitigation

- Ecological enhancement of land (e.g. recutting of former ditches, removal of hedgerows, reseeding grassland) at Maerdy Farm, Tatton Farm and Caldicot Moor.
- Provision of three replacement badger setts.
- Provision of bat barn north of Magor.
- Use of woodland soils and rootstocks in new planting areas.
- Provision of bat boxes.
- Investigate the potential for translocation of waxcap turf.

10.5.13 Further details of the proposed mitigation measures are provided in this section.

No Construction in the Wetted Channels of the Rivers Usk and Ebbw

10.5.14 As explained in Chapter 2: Scheme Description, the River Usk Crossing is proposed to take the form of a 2.1 km long elevated structure, including a high level cable stayed bridge over the river. The cable-stayed bridge (chainage 9736 to chainage 10488) would be 752 m long comprising two 156 metre long back spans and a 440 metre long main span over the River Usk. The cable stays would be supported on two towers, each 146 m high. As shown on Figure 2.13b

the bridge deck would be approximately 30 m above the saltmarsh on the eastern bank of the Usk.

10.5.15 The bridge piers would be located outside the wetted channel. The wetted channel has been defined in discussion with NRW as being the extent of the channel below Mean High Water as explained in Chapter 2: Scheme Description. The west pier would be located within the Newport Docks area. The east pier would be within the area of saltmarsh on the east bank of the Usk. The land take during construction of the pier would result in loss of a total area of 0.69 ha of this saltmarsh vegetation. Following construction, much of the affected area would return to saltmarsh and the permanent land take would be 0.20 ha.

10.5.16 This would avoid impacts on the river habitat and associated species, particularly migratory and estuarine fish and otter.

Minimise Land Take within the Gwent Levels SSSIs and Avoiding Land Take to the South of the New Section of Motorway

10.5.17 So far as practicable the alignment of the new section of motorway has been designed to avoid the Gwent Levels SSSIs. It has thus been designed to follow a route which skirts the northern edge of the Levels. However, the nature of the corridor is such that in order to achieve suitable alignments and avoid developed areas, some land take in the northern part of the Wentlooge and Caldicot Levels could not be avoided. In discussion with NRW, development of land south of the line of the road has been avoided where this could be achieved. Thus the majority of the water treatment areas within the Levels elements of the new section of motorway have been designed to be north of the road.

10.5.18 Construction land take has also been largely confined to the north of the alignment though the Levels.

Provision of Water Treatment Areas

10.5.19 As explained in Chapter 2: Scheme Description, runoff from the new section of motorway would be intercepted into grassed channels in the road verge. These channels would route surface water overland from the drained carriageway to the water treatment areas.

10.5.20 As explained in Chapter 16: Road Drainage and the Water Environment the grassed channels would be lined with a geosynthetic clay liner (and topsoil) to contain pollutants. The use of grassed channels would reduce the flow rate and would allow for some sediment to be deposited and oily residues and organic matter to be retained and broken down. Where the use of grassed channels is not possible, concrete channels would be utilised.

10.5.21 Where the carriageway is super-elevated the introduction of concrete barriers and maintenance restrictions excludes the use of grassed channels. Here concrete channels would be utilised.

10.5.22 With the exception of discharges to the River Usk and the River Ebbw, drainage from the new section of motorway would be treated through the water treatment areas. These would typically include provision for capture of hydrocarbons and grit prior to runoff entering the main attenuation lagoons.

10.5.23 The drainage of the River Usk Crossing would consist of kerb drainage to an outfall pipe that would run along the central reservation. On the west side of the River Usk, drainage would discharge into the River Ebbw via an oil separator. On the east side, drainage would discharge to the River Usk via a storage lagoon and a field ditch.

10.5.24 As explained in Chapter 16: Road Drainage and the Water Environment, the water treatment areas are capable of attenuating 1 in 100 year rain events (plus climate change) as well as reducing concentrations of highway derived chemical constituents to ambient levels.

10.5.25 These measures would protect the watercourses and associated species, particularly aquatic macrophytes, freshwater fish and invertebrates, against potential effects of water pollution, and in turn the populations of water vole and otter which depend on them.

Maintaining Existing Reen Connections

10.5.26 As explained in Chapter 2: Scheme Description and Appendix 2.3: Reen Mitigation Strategy, culvert crossings or reen bridges would be provided for each main reen in order to maintain connectivity within the reen system.

10.5.27 Appendix 3.1: Buildability Report explains that constructing the culverts early in the construction programme would maintain connectivity of the reen and ditch network and reduce potential disruption to ecology and reduce the risk of flooding in the area. Ground treatment measures in the form of precast driven piling would be required beneath these new culverts to prevent them settling and sinking into the soft organic layers below. The proposed culverts would range from 900 mm to 1.8 m diameter concrete pipes, to 1.8 m x 1.8 m to 4.0 m x 4.0 m precast concrete box culvert units. Each culvert crossing would be installed on a half and half basis with a temporary piped crossing installed within the existing channel to one side of the works.

10.5.28 This would maintain the connectivity of the freshwater ecosystem which is the basis of much of the interest of the Gwent Levels SSSIs and allow the passage of wildlife, particularly fish, otter and water vole across the line of the road.

Provision of Permanent Mammal Fencing

10.5.29 As shown on the Environmental Masterplan(EMP) (Figure 2.6), permanent mammal fencing would be provided along most of the length of the new section of motorway, other than the elevated section through Newport Docks and the viaduct to the east of the Usk where fencing would not be necessary. The fencing would be designed in accordance with the guidance provided in the DMRB Volume 10, Section 4, Part 2 (2001) and Part 4 (1999).

10.5.30 The mammal fencing would be specifically designed to prevent otter and badger from accessing the working area.

Avoidance of Lighting Other than at Junctions and River Crossings

10.5.31 As explained in Chapter 2: Scheme Description, the new section of motorway would generally be unlit other than at the following locations.

- On the approaches to and throughout the Castleton Interchange.

- On the approaches to the Docks Way Junction and over the full extent of the River Usk Crossing.
- 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.
- On the approaches to and throughout the Magor Interchange.

10.5.32 The locations of lighting columns are shown on the General Arrangement Drawings at Figure 2.4. Much wildlife is active at night, and the behaviour of species such as bats in particular is affected by light.

Design of Lighting of the River Usk and River Ebbw Crossings

10.5.33 The design of the permanent lighting for the River Usk and River Ebbw crossings would avoid lighting of the river channels and banks in order to reduce the effects of lighting on migratory fish and otter in particular.

Minimise Light Spill through Lighting Design

10.5.34 As explained in Chapter 2: Scheme Description, 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. As indicated above, much wildlife is active at night, and the behaviour of bats in particular is affected by light.

Provision of Mammal Crossings

10.5.35 As shown on the Environmental Masterplan (EMP) (Figure 2.6), a number of mammal crossings are proposed along the length of the proposed new section of motorway. At the western end around the Castleton Interchange, these would be provided primarily to provide means for dormice to cross the new road between areas of suitable habitat, both existing and to be provided as part of the Scheme. Over the remainder of the route, they would be provided to provide crossing points primarily for badger, otter and bats. The crossings would be constructed using 900 mm diameter concrete pipes and would be would be designed in accordance with the guidance provided in the DMRB Volume 10, Section 4, Part 2 (2001) and Part 4 (1999). These crossings would enable species such as badger, otter, dormouse, water vole, hedgehog and some bats to cross the line of the new section of motorway.

Provision of Mammal Tunnels Adjacent to Reen Culverts

10.5.36 The locations of the culverts to be provided for the reens which would be crossed by the new section of motorway are shown on the EMP (Figure 2.6). A separate dry underpass of 900 mm diameter would be provided adjacent to each culvert in accordance with guidelines published in DMRB Volume 10, Section 4, Part 4 (Highways Agency, 1999).

10.5.37 The permanent mammal fencing for the Scheme would be designed to guide animals to the culverts and other crossing points. These crossings would enable species such as badger, otter, water vole, hedgehog and some bats to cross the new section of motorway.

Design of Planting to Guide Bats to Culverts

10.5.38 The areas of tree and shrub planting which are included in the Scheme are shown on the EMP (Figure 2.6). Planting of trees and scrub can help to guide bats towards entrances to culverts and other potential crossing points, thereby increasing the potential for use by bats (Highways Agency, 2011). Therefore, as part of the mitigation for the Scheme, where practicable, the detailed design of planting would take account of the need to guide bats into culverts, mammal crossings, underpasses and/or overbridges, in particular those crossing points in areas of high and very high value bat habitat (as described in Table 10.18 and shown on Figure 10.8).

10.5.39 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.

10.5.40 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) would be installed between crossing points and retained habitats in or connected to high and very high bat activity areas. These would be installed during night time hours between at least March and September inclusive (the main period of bat activity) and until landscape planting has become sufficiently developed to provide a permanent alternative.

Provision of Eel Passes on New Sluices

10.5.41 As explained in Chapter 2: Scheme Description and Appendix 2.2: Drainage Strategy, tilting weirs would regulate flows at the head and outflow of the cross flow culverts. This would allow the regulation of water level and flow along the entire length of the new section of motorway. In addition, the sluices can be utilised when maintaining the reens and culverts by diverting flows from one catchment to another.

10.5.42 Eel passes would be provided on all new sluices which may be constructed as part of the Scheme. These would be designed in accordance with the guidance provided in *Elver and eel passes - A guide to the design and implementation of passage solutions at weirs, tidal gates and sluices* (Environment Agency, Undated).

Use of Plant Material from Existing Reens and Ditches to Encourage Colonisation by Aquatic Macrophytes

10.5.43 Where practicable and subject to NRW approval, plant material from existing reens and ditches which would be lost, and also, by agreement, material arising from NRW dredging of watercourses would be used to encourage colonisation of new reens and ditches by aquatic macrophytes.

Replacement of Reens and Field Ditches

10.5.44 As explained in Chapter 2: Scheme Description and the Reen Mitigation Strategy (Appendix 2.3), 2568 m of reen and 9136 m of field ditches would be infilled or culverted during the construction of the new section of motorway. These would be replaced by a total of 2657 m of new main reen and 9771 m of new field ditch.

10.5.45 New reens would be provided along the north of the new section of motorway in areas where existing reens would be cut off by the new motorway. The proposals are that the reens would be excavated to a depth of 2.0 m with 1 in 1 side slopes, a 0.7 m berm, and would be approximately 5.7m wide at the surface. These new reens would connect reens cut off by the new section of motorway, with sluices to allow management of water levels.

10.5.46 Where existing field ditches would be cut off by the new section of motorway, new field ditches would be provided. These would be 2.5 m wide with 1 in 1 slopes and a depth of 1 m. These would connect to the nearest main reens to provide connectivity.

10.5.47 This would ensure that there was no reduction in the extent of the freshwater ecosystem which is the basis of much of the interest of the Gwent Levels SSSIs. In addition the provision of berms within the replacement reens, and the lack of shading hedgerows, would provide enhanced opportunities for growth of aquatic macrophytes compared to some of the reens which they would replace.

Landscape/Habitat Provision Shown on the Environmental Masterplan (Figure 2.6)

10.5.48 The landscape/habitat provision shown on the Environmental Masterplan (Figure 2.6) includes planting of the following.

- 83.1 ha of woodland.
- 19.8 ha of linear belts of trees and shrubs.
- 26.1 ha of species rich grassland.
- 9.86 ha of reedbeds.
- 3.60 km of hedgerows and hedgerows with trees.

10.5.49 This would serve to replace habitats that would be lost as a result of the construction of the Scheme.

Replacement of Saltmarsh

10.5.50 In order to mitigate for the permanent loss of 0.20 ha of saltmarsh habitat at the location of the River Usk Crossing (East Pier), replacement habitat would be created at the location of the bridge construction compound to the south of the River Usk Crossing adjacent to the drainage attenuation lagoon as shown on the EMP (Figure 2.6). This would involve creation of a new flood bank on the landward side of this area and reduction of the level of the site to that of the existing saltmarsh ranging from approximately. 4.79m above ordnance datum (AoD) (mean high water) at the river to around 7.00 m AoD at the inland end (a little above MHWS).

10.5.51 The topography of the saltmarsh in the area affected by the River Usk Crossing construction compound would be reinstated to an elevation similar to that of the surrounding area. The restored area would be smoothed over to remove any deep depressions on completion of the works to encourage the recovery of saltmarsh vegetation.

Ecological Enhancement of Land at Maerdy Farm, Tatton Farm and Caldicot Moor

10.5.52 As explained in the SSSI Mitigation Strategy at Appendix 10.35, the Scheme would result in the loss of reen and ditch habitat which would have consequent effects on aquatic macrophytes, insects and other invertebrates associated with these habitats, and would result in loss of vegetation which supports shrill carder bee.

10.5.53 Specific mitigation measures are included as part of the Scheme to mitigate these effects, principally through the Reen Mitigation Strategy (Appendix 2.3) which includes replacement of the lost lengths of reens and field ditches with a greater length of each, and provision of suitable habitat for shrill carder bee, principally on the embankments of the new section of motorway.

10.5.54 However, some 125 ha of land within the Gwent Levels SSSIs would be affected by the Scheme, of which some 86 ha would be grazing marsh (measured as all grassland within the Gwent Levels SSSIs within the footprint of the proposed new section of motorway). Other land includes arable land, areas of hardstanding and other land which does not contribute to the interest of the Gwent Levels SSSIs.

10.5.55 The aim of the SSSI Mitigation Strategy is to provide mitigation for the loss of coastal grazing marsh habitat as a result of the Scheme and to ecologically enhance land within the Gwent Levels SSSIs.

10.5.56 Three potential mitigation areas have been identified as being of potential value with regard to the aims of the mitigation strategy: Maerdy Farm, Tatton Farm and Caldicot Moor. Section 2 of the strategy describes these sites, their locations, existing management practices, habitats and protected species known to utilise them. The actual extent of land within these areas which would be required to provide mitigation is to be agreed with NRW.

10.5.57 The Tatton Farm potential mitigation area is located to the east of the River Usk, between Broadstreet Common and the A4810. The site covers approximately 17 ha and comprises species-poor semi-improved grassland fields bordered by reens, ditches and hedgerows. The farm is a Welsh Government owned and tenanted farm and forms part of the Gwent Levels - Nash and Goldcliff SSSI. The site was selected as it is land already in Welsh Government ownership within the Gwent Levels SSSIs where there is the potential to enhance the valued SSSI features.

10.5.58 The Maerdy Farm potential mitigation area is located to the west of the River Usk, south of Coedkernew and Duffryn. The site covers approximately 24 ha. The farm is a freehold arable farm. Hedgerows and watercourses (including reens) act as field boundaries across the holding. The land forms part of the Gwent Levels - St Bride's SSSI. The site was selected as it is largely arable land within the Gwent Levels SSSIs where there is the potential to enhance the valued SSSI features, particularly by reversion of arable land to grassland.

10.5.59 Caldicot Moor potential mitigation area is located to the west of Undy, south of the existing M4. The site covers approximately 113 ha and largely comprises arable, improved grassland and species-poor semi-improved grassland fields bordered by reens, ditches and hedgerows (mostly species-poor). It is located outside the Gwent Levels SSSIs but immediately adjacent to the Gwent Levels –

Magor and Undy SSSI. The land is in several freehold ownerships. The site was selected as it is largely arable land within the Gwent Levels SSSIs where there is the potential to enhance the habitats for which the SSSIs are valued, particularly by reversion of arable land to grassland, improving biodiversity value of the existing grasslands and re-cutting historic field ditches.

10.5.60 Section 3 of the strategy describes the objectives of the mitigation strategy with regard to each site, and Section 4 provides the broad prescriptions for mitigation and management measures proposed. The final detailed prescriptions for mitigation and management will be agreed with NRW and will be included in Mitigation Area Management Plans.

10.5.61 A range of enhancement measures are proposed for these areas including the following.

- Arable conversion to species diverse grassland using an appropriate grass seed mix.
- Increase the area of species diverse grassland.
- Enhance species diversity of existing grassland.
- Increase the amount of reen and ditch habitat.
- Enhance the biodiversity value of existing watercourses.
- Maintain water level management.
- Enhance and manage watercourses for water voles.
- Manage grassland to encourage ground nesting birds and invertebrates.
- Habitat improvements for reptiles and amphibians.
- Install bat boxes.
- Install barn owl nest boxes.

10.5.62 As well as mitigation for the loss of grazing marsh habitat as a result of constructon of the Scheme, this would also enhance habitat for the range of wildlife associated with the Gwent Levels grasslands.

Provision of Replacement Badger Setts

10.5.63 Three artificial setts would be constructed in order to provide alternative habitat for use by any badgers displaced from the three active main setts which would require closure to construct the new section of motorway (see mitigation during construction later in this section).

10.5.64 The artificial setts would be constructed prior to closing the main setts and all closures of active setts would be carried out in accordance with the requirements of an NRW licence for badgers, which would be obtained prior to the commencement of licenced works. The artificial setts would be constructed in areas that would enable badgers to continue to gain access to parts of their existing home range that contain significant areas of habitat of potential value.

10.5.65 Should pre-construction surveys report the presence of new main setts that would need to be closed, one artificial sett would be constructed in place of each new main sett to be closed.

10.5.66 Outlier setts are less frequently used or may be used on a temporary basis only and replacement setts for these would not be constructed.

Provision of Bat Barn North of Magor

10.5.67 As shown on the EMP (Figure 2.6) a bat barn would be provided at water treatment area 11c north of Junction 23A at Magor to replace the roost at Magor Vicarage which would be removed to construct the Scheme. This would be a purpose built building, parts of which would receive full sunlight for the majority of the day, providing warm conditions for breeding bats. Cool areas would also be included for spring, autumn and winter roosting. Bats that use buildings, and for which such roosts are suitable can generally be divided into four categories.

- Crevice-dwelling bats (which tend to be hidden from view) include common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Brandt's bat and whiskered bat.
- Roof-void dwelling bats (that may be visible on roof timbers) are serotine, Leisler's bat, Daubenton's bat and barbastelle.
- Bats that need flight space in certain types of roost are Natterer's bat, and brown and grey long-eared bat.
- Bats that need flight space and flying access into the roost are greater horseshoe and lesser horseshoe bat.

Use of Woodland Soils and Rootstocks in New Planting Areas

10.5.68 At Berryhill Farm, during clearance of the existing wood, to the extent practicable, coppice stools of hazel and other shrub species would be lifted and replanted in areas of woodland planting to the east of New Park Farm north of the new Castleton Interchange in an area which would not otherwise be disturbed. Woodland topsoil from this wood would also be stripped and placed in new planting areas to encourage the establishment of the woodland ground flora.

Provision of Bat Boxes

10.5.69 Artificial bat roost boxes to replace roosts which would be removed for the Scheme would be installed in suitable trees in field boundaries on the edges of the Scheme, such as on the margins of construction sites and borrow pits, and elsewhere by agreement. The number and locations of the bat boxes would be agreed with NRW.

Investigate the Potential for Translocation of Waxcap Turf

10.5.70 The potential for the translocation of waxcap turf from grasslands at Pwll Diwaelod and Pound Hilll would be investigated.

Construction

10.5.71 As explained in Chapter 16: Road Drainage and the Water Environment, the Pollution Control and Prevention Plan (see Annex E to Appendix 3.2: The Pre-CEMP) identifies the measures proposed to minimise risks of contamination during the construction phase.

10.5.72 Chapter 16 also explains that the Outline Ground and Surface Water Management Plan is provided (Annex G to Appendix 3.2: The Pre-CEMP). This

will form the basis of the final Ground and Surface Water Management Plan, which will consider all drainage required during the construction phase with reference to industry and regulatory pollution prevention guidelines. In particular the following will be included.

- Description of the design of each element of surface water management system required to manage surface water runoff during construction and potential risks to surface waters. This will include consideration of temporary storage and settlement requirements to manage sediment load of waters.
- Description of the water quality criteria to ensure any discharge to receiving watercourses meets regulatory requirements.
- Description of an appropriate monitoring regime to ensure that water quality will be protected to the satisfaction of the regulatory authorities.
- Consideration of discharges to the Gwent Levels, inland watercourses and tidal waterbodies as required.

10.5.73 Chapter 16 also explains that a site-specific piling risk assessment will be provided, to ensure the most appropriate piling approach and methodology is utilised for the construction of pile foundations for embankments and bridge tower and viaduct pier foundations. The piling risk assessment will minimise the potential for the creation of new pathways and hence the cross contamination of groundwater and surface water.

10.5.74 The Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2) explain how a pollution incident during construction would be managed and reported to minimise its impacts on the environment.

10.5.75 Measures to be implemented during construction, over and above the measures to control pollution referred to above would include the following.

- Biosecurity method statement for site works, including ecology surveys.
- Capture and translocation of dormouse.
- Capture and translocation of reptiles.
- Capture and translocation of water vole.
- Capture and translocation of great crested newt.
- Removal of bat roosts at the appropriate season.
- Closure of badger setts at the appropriate season.
- Pre-construction surveys for bats, badger, water vole, otter, great crested newt and features of importance to grass snake to confirm measures required during construction.
- Clearance of vegetation suitable for nesting birds outside the bird breeding season.
- Management of surface water and groundwater during construction including maintenance of water levels in reens and field ditches, de-watering of borrow pits and provision of temporary water treatment areas.
- Construction lighting would be designed and managed to minimise light spill outside the working area.

- Installation of piles for the East Pier of the River Usk crossing outside the main fish migration period.
- Provision of mammal fencing during construction if and where required.
- Provision of means of escape from excavations.
- Provision of barn owl nest boxes.
- Construction sites at Great Pencarn, Newport Docks and Tata Steel would be restored on completion of construction.

10.5.76 Further detail of these measures is provided below.

Biosecurity Method Statement for Site Works, including Ecology Surveys

10.5.77 Works (including surveys and monitoring visits) would be undertaken in accordance with a biosecurity risk assessment and safe system of work, a copy of which would be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2). The risk assessment and safe system of work would take into account species-specific guidelines for management and control of non-native invasive species produced by the Non-Native Species Secretariat (NNSS) and NRW.

10.5.78 Any infected (disease or pest) plants, prunings or timber arisings would be dealt with in accordance with arboricultural best practice and up-to-date best practice guidelines published by NRW.

10.5.79 Such measures would be undertaken where invasive species are known to be present and whenever there is the potential to disturb, cause the spread of and/or incidentally transport off-site (e.g. on tyres, equipment, footwear or clothing) invasive species. This would include during ecology surveys and monitoring visits as well as during construction.

Capture and Translocation of Dormouse

10.5.80 The Scheme would result in the following loss of woodland, scrub and hedgerows in areas where hazel dormice have been recorded (as shown on Figure 10.8 and described at Appendices 10.9 and 10.26).

- Castleton: broadleaved woodland (semi-natural and plantation), mixed plantation; continuous scrub and hedgerows.
- Tata Steel land to the south of the A4810: broadleaved woodland (semi-natural and plantation), mixed plantation; continuous/dense scrub and hedgerows.
- Knollbury/north of Undy: broadleaved woodland (semi-natural and plantation) and hedgerows.
- Minnet's Lane: hedgerows to the north of Rogiet and the existing M4.

10.5.81 Therefore as part of the mitigation for the Scheme, due to the amount of habitat of known or potential value to dormice that would be lost to construction, hazel dormice would be captured and translocated to an appropriate off-site receptor site prior to the commencement of construction.

10.5.82 The methodology for trapping, handling and translocation and post-translocation monitoring and reporting would be undertaken in accordance with best practice

guidelines (including Bright *et al.* 2006) and a European Protected Species Licence which would be obtained in advance of the works. The receptor site would be agreed with NRW and secured by agreement prior to the granting of an European Protected Species licence and commencement of licenced works.

10.5.83 Surveys of potential woodland receptor sites in the surrounding area in order to identify a suitable receptor site are ongoing. Results of hazel nut searches undertaken during the winter of 2015 have reported no signs that could confirm the presence of hazel dormice in Coed Mawr Wood, which is located less than 5 km to the north of the western end of the new section of motorway and is owned by NRW. No historic records of dormice in Coed Mawr woodland were reported during the desk study. The woodland is a suitable size to be used as a receptor site, includes broadleaved habitat of potential value to dormice and is well connected to surrounding areas of habitat of potential value to dormice, including hedgerows and woodland. The next stage would be to carry out a dormouse nest tube survey of this wood in 2016 in order to help confirm the likely absence or presence of dormice. Should results of these surveys confirm dormice are likely to be absent, the Method Statement for the translocation would be agreed with NRW, which would include any enhancement measures necessary to ensure the woodland is in favourable condition for use as a receptor site, prior to the commencement of any translocation.

10.5.84 If a suitable receptor site has not been agreed, or should the receptor site not be in favourable condition prior to the commencement of translocation, captured dormice would be maintained as a captive population at a suitable facility for re-release once the receptor site has been restored/enhanced to favourable condition.

10.5.85 If required, in principle agreement has been reached with Bristol Zoo regarding accommodation of a captive population until such time as they can be released if such a facility is required.

10.5.86 The translocation would be undertaken by appropriately experienced and qualified ecologists named on the NRW licence for dormice. The ecologists would work under the guidance of the ECoW. Reports of all captures and translocations would be maintained by the ECoW and would be provided on a regular basis to the Project Manager and NRW.

Capture and Translocation of Reptiles

10.5.87 Prior to commencement of construction in areas where common lizard and slow worm populations have been identified, reptile fencing would be installed and reptiles would be captured and transferred to suitable habitat on the margin of the Scheme, or to suitable habitat within the SSSI mitigation areas (Appendix 10.35) or elsewhere by agreement. The detailed method statement for the capture and translocation would be agreed with NRW in advance.

10.5.88 The translocation would be undertaken by appropriately experienced and qualified ecologists, working under the guidance of the ECoW. Reports of all captures and translocations would be maintained by the ECoW and would be provided on a regular basis to the Project Manager and NRW.

Capture and Translocation of Water Vole

10.5.89 Mitigation measures designed to displace or translocate water voles from working areas (excluding temporary access routes) to favourable receptor sites prior to the commencement of construction would be set in place in accordance with a water vole Method Statement. The exact area of clearance at any location would be determined with regard to habitats and the type of land use and would be agreed with NRW.

10.5.90 Measures included in the water vole Method Statement may include: habitat management (e.g. clearance of scrub and mowing of grass cover) in order to remove bankside ground cover and thereby help to displace and/or deter water voles throughout the construction phase in an area; the excavation and infilling of burrows under an ecological watching brief; the drainage of watercourse prior to infilling in order to deter water voles; the installation of steel mesh across excavated banks and/or the banks and channels of newly constructed watercourses in order to prevent water voles from (re-)excavating burrows; and if necessary the capture and translocation of individuals to pre-prepared receptor sites in the SSSI mitigation areas (Appendix 10.35) or elsewhere by agreement.

10.5.91 If required, the receptor sites would be agreed with NRW, and they would not form part of any other water vole's home range and would contain habitat favourable to water voles. Where necessary, habitat creation and/or enhancement measures would be undertaken prior to any displacement or translocation in order to ensure receptor sites are in favourable condition prior to translocation. Measures could include clearance of bankside scrub and mowing to encourage the development of good ground cover. Should a receptor site be located outside the existing area covered by the Gwent Wildlife Trust mink control programme, a mink control management plan would be instated prior to translocation in order to help ensure any displacement or translocation is successful.

10.5.92 The translocation would be undertaken by appropriately experienced and qualified ecologists, working under the guidance of the ECoW. Reports of all captures and translocations would be maintained by the ECoW and would be provided on a regular basis to the Project Manager and NRW.

Capture and Translocation of Great Crested Newt

10.5.93 Mitigation measures that would form part of any great crested newt licence application, and would be undertaken at an appropriate time of year and during appropriate local weather conditions, would include the following.

- Installation of great crested newt exclusion fencing around working areas within 250 m of habitat known to or likely to be inhabited by great crested newts, in order to prevent great crested newts from entering, but to enable them to leave, the construction site.
- If required pre-construction trapping in order to capture and translocate any great crested newts from within exclusion fenced areas to appropriate receptor sites outside working areas, for example in the SSSI mitigation areas (Appendix 10.35) or elsewhere by agreement.

- Clearance of habitat of potential value to newts from within exclusion fencing in order to capture any remaining newts and translocate them to the approved receptor sites.
- Installation of culverts.

10.5.94 Where necessary, habitat creation and/or enhancement measures would be undertaken in order to ensure receptor sites are in favourable condition prior to displacement or translocation. Measures could include clearance of overhanging and over-shading scrub along the banks of watercourses/waterbodies in order to encourage the establishment and spread of aquatic vegetation, and provision of hibernacula, potentially using suitable materials derived from site clearance. These measures would also be beneficial to the other amphibian species recorded in the area.

10.5.95 If required, the translocation would be undertaken by appropriately experienced and qualified ecologists, working under the guidance of the ECoW. Reports of all captures and translocations would be maintained by the ECoW and would be provided on a regular basis to the Project Manager and NRW.

Removal of Bat Roosts at the Appropriate Season

10.5.96 As explained in Section 10.4, the following buildings have been identified as bat roosts.

- Old Stores in Newport Docks.
- Pye Corner Farm.
- Tatton Farm.
- The Vicarage, Magor.

10.5.97 Several trees have also been identified as supporting bat roosts.

10.5.98 Mitigation measures would include further pre-construction surveys of mature trees and buildings that would be felled or demolished, or would be at potential risk of significant noise disturbance from the works, in order to confirm the presence/absence of bat roosts. Should any roosts be confirmed and should works require the loss of the roost or be likely to result in the displacement of bats, a European Protected Species licence would be obtained prior to the commencement of works. The pre-construction surveys would inform the licence application and associated method statement. A bat barn would be provided north of Magor and bat boxes would be provided elsewhere within the new section of motorway, within the SSSI mitigation areas, or elsewhere by agreement.

Closure of Badger Setts at the Appropriate Season

10.5.99 Results of the 2014 and 2015 badger surveys (Confidential Appendices 10.37 and 10.38) confirm the following badger setts to be located within or immediately adjacent to working areas.

- Main sett E (active)
- Main sett H (active in 2014; inactive late 2015)
- Main sett I (active)

- Outlier sett V (active)
- Outlier sett Q (active)
- Outlier sett J (active)
- Outlier sett M (disused)
- Outlier sett Y (disused)
- Outlier sett Z (disused)

10.5.100 Therefore, in order to protect any badgers that might be utilising the setts and prevent a breach of the Protection of Badgers Act 1992, badgers would need to be displaced from the setts prior to closing them.

10.5.101 As explained earlier in this section, as part of the mitigation for the Scheme, three artificial setts would be constructed to provide alternative setts for badgers that could be displaced from the three active main setts E, H and I. Suitable locations have been included in the Draft Orders for the Scheme.

Pre-construction Surveys to Confirm Measures Required during Construction

10.5.102 In order to support the Method Statements which would support European Protected Species licence applications for disturbance of bats, otter and great crested newt; a licence under the Protection of Badgers Act 1992 for closure of badger setts; and for a translocation licence for water vole if required, further surveys for these species would be carried out in advance of commencement of construction. Features of potential importance to grass snakes, such as leaf piles, would be identified and where these would be affected by the Scheme would be moved to suitable locations at the Scheme boundary or elsewhere by agreement.

10.5.103 Where licences are required, 'ghost' licence applications would be prepared and discussed with NRW in advance of the decision on the Orders in order to avoid delays when and if the formal applications are made.

Clearance of Vegetation Suitable for Nesting Birds outside the Bird Breeding Season

10.5.104 As explained in Appendix 3.1: Buildability Report, tree clearance and protection fencing would be planned with the ecological supervisor in accordance with industry standards and guidelines. Tree clearance works would be undertaken outside the normal breeding bird season (March to August) where practicable.

10.5.105 Where unforeseen delays or unexpected circumstances prevent this, additional measures would be put into place to prevent disturbance or harm to breeding birds. Such measures would include detailed hand-searching and distance-observation of any potential bird-nesting habitats requiring clearance during the bird-nesting season by suitably experienced ecologists.

Management of Surface Water and Groundwater during Construction

10.5.106 As explained in Chapter 16: Road Drainage and the Water Environment, the Outline Ground and Surface Water Management Plan (Annex G to Appendix 3.2: The Pre-CEMP) would form the basis for the final Ground and Surface Water

Management Plan, which would consider all drainage required during the construction phase and would reference all industry and regulatory pollution prevention guidelines. The plan would describe the design of each element of the surface water management system required to manage surface water runoff during construction and potential risks to surface waters. This would include consideration of temporary storage and settlement requirements to manage the sediment load of waters. The plan would define the water quality criteria to ensure any discharge to receiving watercourses meets regulatory requirements. The plan would also define an appropriate monitoring regime to ensure water quality would be protected to the satisfaction of the regulatory authorities. The plan would consider discharges to the Gwent Levels, inland watercourses and tidal waterbodies as required.

10.5.107 The methodology for the excavation and installation for new culverts along reens and selected field ditches is described in Appendix 3.1: Buildability Report. Generally the method would be as follows.

- Construct replacement reen(s) parallel to the new road.
- Install temporary pipe crossing in existing channels to permit plant and materials to cross for these works and transit along the trace.
- Connect the new reens / field ditches into north and / south to the existing system.
- Prevent flow through existing reen / field ditch.
- Introduce plant material from reens and ditches to be infilled to new channels to encourage colonisation.

10.5.108 Where practicable, the layout of areas of land identified for temporary construction areas would avoid existing reens and ditches to minimise the infilling of these features.

10.5.109 To facilitate the process of recolonisation of replacement reens and ditches by aquatic vegetation and invertebrates, subject to approval from NRW, material removed from existing reens and ditches proposed to be infilled (subject to timing) and material from annual maintenance of the reen network would be introduced into the new watercourses to speed up recolonisation. In particular this would be considered where there is the known presence of notable species such as the great silver water beetle (recorded in Middle Road Reen and Elver Pill Reen) and the water beetle *Hydaticus transversalis (*recorded in the Old Dairy Reen and Pont-y-Cwcw Reen).

10.5.110 For any watercourses which would be severed from the network for the duration of construction, consideration would be given to the translocation of fish from these watercourses to those still connected to the main reen network.

10.5.111 At some locations it may be necessary to temporarily de-water sections of reens prior to or following connection to culverts. In such instance care would be taken to avoid trapping fish in these sections.

Construction Lighting would be Designed and Managed to Minimise Light Spill Outside the Working Area

10.5.112 As explained in Chapter 3: Scheme Constructon, 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 during the night time. Such task lighting would be positioned at low level on posts and directed at the most frequently used areas of work.

10.5.113 Inward facing security lighting would be provided at construction compounds on a 24 hour basis.

10.5.114 As explained in Chapter 3: Scheme Construction a more detailed lighting strategy for the construction period would be developed to identify the type of lighting to be used and measures to be implemented to reduce light spill. The strategy would be agreed with the local planning authority and the regulator.

Installation of Piles for the East Pier of the River Usk Crossing Outside the Main Fish Migration Period

10.5.115 As set out in the Pre-CEMP (Appendix 3.2) piling to install the cofferdam and pylon piles for the east pylon of the River Usk Crossing would be scheduled to avoid the period of highest sensitivity for underwater noise related impacts on migratory fish in the River Usk which has been identified as March to June (inclusive). Confirmation as to the requirement to include other piles (e.g. those for the west pylon and some of the viaduct piles) within this seasonal restriction would be determined following the test pile and associated noise monitoring in consultation with NRW.

10.5.116 High vibration activity would be limited to 30 minutes per eight hour shift and would not be undertaken one hour either side of high tide.

Provision of Mammal Fencing During Construction

10.5.117 As explained in Chapter 3: Scheme Construction, temporary boundary fencing would be installed around the perimeter of the whole site to prevent unauthorised access. Areas out of bounds to construction activities (e.g. soil storage areas, ecologically sensitive areas or archaeological sites) would also be fenced off or suitably demarcated to ensure plant and machinery cannot enter. Where necessary to ensure that badgers and otters could not access the working areas, mammal fencing would be attached to the boundary fence.

Provision of Means of Escape from Excavations

10.5.118 Any excavations that are located outside the mammal exclusion fencing that are more than 0.5 m deep would be fenced individually; covered overnight where practicable; walls would be re-profiled so as to enable mammals and other wildlife to walk out of the excavation; or a means of escape would be provided, such as a wooden plank rested against the wall of an excavation that could act as a ladder.

Provision of Barn Owl Boxes

10.5.119 Barn owl nest boxes would be provided in trees around the boundaries of the mitigation land at Green Moor (chainage 17900 to 19100) in the same area as the potential barn owl nest but further from the construction area and also within the SSSI mitigation areas (Appendix 10.35).

Construction Sites at Great Pencarn, Newport Docks and Tata Steel would be Restored on Completion of Construction

10.5.120 As explained in Chapter 3: Scheme Construction, following completion of the works all temporary construction work sites would be removed and the land affected would be restored. In restoring the construction sites at Great Pencarn, within Newport Docks and Tata Steel, elements of the open mosaic habitat on previously developed land habitat would be incorporated and the habitat requirements of shrill carder bee (and terrestrial invertebrates generally) and reptiles would be taken into account. In particular the seed mixes used in restoring these areas would include food plant species of value to shrill carder bee.

Monitoring

10.5.121 Monitoring would be undertaken both during the construction and the operation of the new section of motorway to confirm the effectiveness of mitigation measures, and if necessary, to inform the need for any changes in management of impacts.

10.5.122 The mammal exclusion fencing would be monitored throughout the construction phase to ensure that it remains intact. The ECoW would be responsible for ensuring regular monitoring is undertaken and that repairs are made as soon as practicable.

10.5.123 The establishment of the landscape elements included in the EMP (Figure 2.6) would be monitored by the Contractor during the construction and maintenance periods. South Wales Trunk Road Agent (SWTRA) would then be responsible for ongoing monitoring and maintenance.

10.5.124 Requirements for monitoring of protected species would be set out in the European Protected Species Licence Method Statements and other species Method Statements. This would include monitoring of populations of dormouse, bats, water vole, badger and shrill carder bee.

10.6 Effects Resulting from Changes in Air Quality

10.6.1 The effects of changes in air quality as a result of the construction and operation of the Scheme are described in Chapter 7: Air Quality of the ES. This explains that ecological sites designated at international, European or national level have been included in the assessment. A desk-based review was undertaken to determine baseline air quality conditions for both human and ecological receptors.

Construction Effects

10.6.2 A qualitative assessment was made of the effects of dust likely to be generated during construction on receptors within 350 m of the boundary of the new section

of motorway construction area. The new section of motorway would cross six areas with national or international ecological designations.

- River Usk/Afon Wysg Special Area of Conservation (SAC).
- Gwent Levels - Nash and Goldcliff Site of Specific Scientific Interest (SSSI).
- Gwent Levels - Redwick and Llandevenny SSSI.
- Gwent Levels - St. Brides SSSI.
- Gwent Levels – Whitson SSSI.
- River Usk/Afon Wysg SSSI.

10.6.3 As the Scheme crosses the SAC and SSSIs, they are therefore at risk of being affected by dust soiling. Due to the large dust emission magnitude, there would be a high risk in relation to dust soiling and ecology, prior to the implementation of mitigation measures.

10.6.4 The IAQM guidance states that the aim should be to prevent significant effects on receptors through the use of effective mitigation. Details of the proposed mitigation measures are set out in Chapter 7: Air Quality.

10.6.5 The IAQM guidance indicates that in most cases, once mitigation measures are applied, dust effects would be reduced to negligible levels. Therefore, where mitigation measures are implemented the residual effect would not be significant.

10.6.6 The assessment thus assumes that the measures implemented would be expected to be effective in controlling dust emissions. Thus, in so far as there would be deposition of dust on vegetation, this would only be likely to occur to any significant degree close to areas where heavy equipment is in use over long periods, such as along haul roads. Dust can have two types of effect on vegetation: physical and chemical. Any adverse effect due to physical processes, such as reduced photosynthesis or respiration and transpiration due to the deposition of dust, is naturally countered by rainfall. Average weather statistics from Rhoose Weather Station (21 km from Newport) indicate that the lowest number of days when rain falls in any month is 8 (July) rising to 15 (December) (Norwegian Meteorological Institute, 2016). Dust depositing on leaves would be washed away by rain.

10.6.7 Chemical effects on vegetation are only likely to occur when dust whose chemistry is different from the natural soils in an area is deposited over long periods, for example where highly alkaline dust from a cement works is deposited on heathland vegetation. Whilst limestone from the borrow pits in the eastern part of the new section of motorway would be used in the construction of the road embankment, this would only be for a limited period and given that the soils in the area will be well buffered against chemical change, and the low levels of dust likely to be deposited limited there is no likelihood of such significant effects from dust deposition as a result of the road construction. Similar considerations apply to the potential use of cementitious binders which may be used in soil stabilisation for construction of the haul road across the Levels.

Operational Effects

10.6.8 Although the main impact of oxides of nitrogen (NO_x) on terrestrial ecosystems is via the fertilising effect of nitrogen addition, the gaseous form has been shown to

have a direct phytotoxic effect generally manifested through a reduction in plant growth with rarely any visible injury. The main mechanism by which such growth suppression occurs has not been fully elucidated as impacts (both positive and negative) to varying NO_x concentrations have been observed on the rate of photosynthesis and the balance with dark respiration as well as changes to the pathways by which NO_x is metabolised within the leaf cells, although different effects of NO and NO_2 have also been observed. High concentrations of NO_x have been shown to have a direct necrotic effect on leaves through impacts on cell membranes.

10.6.9 For the operational new section of motorway, effects at ecological receptors relating to NO_x concentrations and nitrogen deposition were assessed in accordance with Annex F of DMRB HA207/07 (Highways Agency *et al.,* 2007). Road traffic is not a significant source of other pollutants to which vegetation may be sensitive, such as ammonia (NH_3) and sulphur dioxide (SO_2), and as such an assessment of these pollutants was scoped out of the assessment.

10.6.10 The predicted changes at ecologically designated sites as a result of the Scheme in the opening year (2022) and future year (2037) as described in Chapter 7: Air Quality are summarised here.

Annual Mean NO_x Concentrations

10.6.11 At the majority of designated sites across the study area, the annual mean NO_x limit value (30 µg/m^3) for the protection of vegetation would be met in the opening year (2022) and future year (2037) of the Scheme. The annual mean NO_x limit value has been applied to all designated sites on a precautionary basis only as all are within 20 km of a town with more than 250,000 inhabitants and therefore the limit value does not apply. Modelled concentrations within 20 m of the centre line of the road are greater than 30 µg/m^3 at two designated sites, Langstone - Llanmartin Meadows SSSI and Severn Estuary SAC/SSSI/SPA/Ramsar site in the opening year and future year without the Scheme in place.

10.6.12 The largest improvement in annual mean NO_x concentrations (10.3 µg/m^3) is predicted at Langstone-Llanmartin Meadows SSSI as a result of the Scheme due to the removal of a large proportion of traffic from the existing M4 corridor and modelled concentrations are predicted to improve to below 30 µg/m^3. A reduction in NO_x concentrations would apply to habitats generally along the corridor of the existing M4 following completion of the Scheme.

10.6.13 The Scheme would result in an increase in annual mean NO_x concentrations (0.4 µg/m^3) at the Severn Estuary SSSI/SAC/SPA/Ramsar site where NO_x concentrations are already greater than 30 µg/m^3 without the Scheme in place. However, in the vicinity of the Scheme this is a marine habitat and therefore does not have vegetation sensitive to changes in gaseous concentrations of NO_x.

10.6.14 The largest increase in annual mean NO_x concentrations is predicted at the Gwent Levels - Redwick and Llandevenny SSSI with an increase of 10.5 µg/m^3 at the closest point to the proposed new section of motorway. Increases in annual mean NO_x concentrations are also predicted at Gwent Levels - Nash & Goldcliff SSSI, Gwent Levels - St Brides SSSI and Gwent Levels - Whitson SSSI as a result of the Scheme. In the do something scenario, annual mean NO_x concentrations at these locations are predicted to be below 30 µg/m^3, with the

exception of the Gwent Levels St Brides SSSI, which is predicted to be 30 µg/m^3 at the closest point to the proposed new section of motorway.

10.6.15 Annual mean NOx concentrations are predicted to be below 30µg/m^3 at all other designated sites in both the do minimum and do something scenario.

Nitrogen Deposition

10.6.16 As set out in Chapter 7: Air Quality, the Scheme would result in an increase in nitrogen deposition rates at all designated sites assessed, with the exception of Langstone - Llanmartin Meadows SSSI. However, the modelled results for both the opening year (2022) and the future year (2037) of the Scheme indicate that the critical loads applied to the designated sites based on the vegetation present (set out in Appendix 7.1 Operational Assessment Methodology) would not be exceeded.

10.6.17 The largest increase in nitrogen deposition (0.5 kg N/ha/yr, 5% of the minimum critical load of 10 kg N/ha/yr) is predicted at the Gwent Levels - St Brides SSSI, Nash & Goldcliff SSSI, Whitson SSSI and Redwick and Llandevenny SSSI at the closest points to the proposed new section of motorway. The largest decrease in nitrogen deposition (0.5 kg N/ha/yr, 5% of the minimum critical load of 10 kg N/ha/yr) would occur at Langstone - Llanmartin Meadows SSSI. As discussed above this is as a result of a large proportion of traffic moving from the existing M4 to the proposed new section of motorway.

Habitats

10.6.18 The habitats along the proposed new section of motorway vary in their sensitivities to nitrogen (N) deposition that may occur as a result of changes to air quality. Therefore, the Air Pollution Information System (APIS) website (www.apis.ac.uk) was interrogated to determine the degree of such sensitivity for all habitats within 200 m of the proposed route (the distance required for such assessment by the DMRB). A number of these habitats are constituent parts of the various designated sites along the route considered above. Where this is the case, it is noted to which site they correspond. The habitats are described broadly in order of the extent to which they occur within the assessment corridor.

Semi-improved Neutral Grassland

10.6.19 The majority of grassland through the assessment corridor is semi-improved neutral grassland within the Gwent Levels SSSIs. Any grassland subject to a degree of agricultural improvement (as these grasslands are) will be less sensitive to the effects of nutrient N deposition than unimproved grassland, with the degree to which this sensitivity varies dependent upon the existing management regime. The semi-improved neutral grasslands along the assessment corridor are grazed to varying degrees by both cattle and horses. It is likely, therefore, that the degree of sensitivity to nutrient N deposition will vary with the intensity of such grazing; grasslands subject to heavy grazing will be less susceptible to additional N inputs than those with lighter grazing regimes as the degree of manure (and hence existing N input) will be higher. While no critical load has been set for such grasslands, the critical load for the more sensitive unimproved grassland (20 kg N/ha/yr) would not be exceeded at any point along the assessment corridor. Therefore, no significant impacts to semi-improved grassland are considered likely.

Improved Grassland

10.6.20 A significant proportion of the assessment corridor comprises agriculturally-improved grassland. Such systems already receive high N loadings as a result of fertiliser/manure additions. Therefore, they are not sensitive to further aerial inputs.

Arable

10.6.21 A number of fields along the assessment corridor comprise arable land. Given the very high N loadings from artificial fertiliser generally applied to such habitats, this habitat is not sensitive to aerial N deposition.

Semi-improved Poor Grassland

10.6.22 Semi-improved poor grasslands are present along the assessment corridor, some of which are within the Gwent Levels SSSIs. These grasslands are floristically less diverse than the semi-improved neutral grassland and therefore their sensitivity to additional N inputs from aerial deposition will be correspondingly less. This is because the grassland sward is already dominated by course grass species with few herbs as a result of existing N inputs from fertiliser.

Unimproved Neutral Grassland

10.6.23 Grasslands that are unimproved in nature are usually floristically diverse and not dominated by the course grasses associated with any degree of agricultural improvement. A number of fields associated within the Gwent Levels SSSIs comprise unimproved neutral grassland. While it is likely that such grasslands will be sensitive to nutrient N addition, the degree of that sensitivity will vary with the phosphorous (P) content of the soil. Nitrogen and phosphorous are usually the two growth-limiting chemicals in most habitats meaning an increase in one will not automatically lead to a change in plant growth rates (and hence habitat species composition) if it is the other that is currently limiting. Therefore, on a precautionary basis, it is assumed that such grassland is nitrogen limited and therefore significant additional nutrient N input would be detrimental to the species composition of such habitats.

10.6.24 The minimum critical load for unimproved grassland set by APIS is 20 kg N/ha/yr. Given that all the predicted deposition rates along the length of the assessment corridor are less than this, no significant impacts on such grassland as a result of the Scheme are likely.

Amenity Grassland

10.6.25 Small areas of amenity grassland occur within the assessment corridor. Such grasslands typically comprise a very small range of hardy grass species and, while they may contain a range of common herbs, are not usually floristically diverse. Therefore, they are not sensitive to nutrient N deposition.

Broadleaved Semi-natural Woodland

10.6.26 Small areas of semi-natural broadleaved woodland are present along the length of the assessment corridor. Nitrogen deposition is not considered to have any significant direct impact on tree growth within the UK. However, other components of the woodland may be sensitive, in particular if lower plants

(bryophytes/lichens) are an important component of the woodland. Such effects can be further exacerbated due to the fact that woodlands are aerodynamically rough surfaces and therefore will intercept a greater amount of any given pollution (represented by them having a higher deposition velocity than grasslands within emission modelling). As with grasslands, the degree of sensitivity of such habitats will depend on the balance of P to N limiting the system.

10.6.27 The woodland along the assessment corridor does not support lower plant communities of note and therefore is unlikely to be sensitive to nutrient nitrogen deposition.

Broadleaved Plantation Woodland

10.6.28 Plantation woodland is present in a small number of locations along the assessment corridor. Such woodlands will be broadly similar in sensitivity to semi-natural woodlands.

10.6.29 As for broadleaved semi-natural woodland, the plantation woodland along the assessment corridor does not support lower plant communities of any significance and is therefore not considered to be sensitive to nutrient nitrogen deposition.

Marshy Grassland

10.6.30 Small areas of marshy grassland occur along the assessment corridor. Such grassland is unlikely to show any significant response to additions of nutrient nitrogen.

Standing Water

10.6.31 One of the key interest features of the Gwent Levels SSSIs are the reens associated with the field boundaries across the levels. The degree to which such habitats are likely to be sensitive to nutrient N deposition will depend greatly on their location relative to agriculturally-improved grassland. Nitrogen is extremely mobile in most systems and is readily leached out from soils into surrounding watercourses when added to terrestrial habitats. Therefore, while those reens near to unimproved grasslands are likely to be more sensitive than those surrounded by improved grassland, no reens within the assessment corridor are completely surrounded by unimproved grassland as such habitats do not occur frequently within the Gwent Levels. Therefore, all reens will be subject to a degree of existing nutrient N input as a result of run-off from surrounding improved/semi-improved grasslands meaning plant communities present within them will already be adapted to such input.

10.6.32 Therefore, it is likely that the majority of reens within the assessment corridor are unlikely to be sensitive to additional nutrient N additions from direct deposition.

Intertidal Mud

10.6.33 Small areas of intertidal mudland occur within the assessment corridor at the River Usk and River Ebbw crossings. That within the River Usk is within the River Usk SAC and the River Usk (Lower Usk) SSSI. Such habitats are inundated by the tide on a daily basis and are therefore not sensitive to nutrient N deposition.

Saltmarsh

10.6.34 Small areas of saltmarsh occur within the assessment corridor at the River Usk and River Ebbw Crossings. That within the River Usk is within the River Usk SAC and the River Usk (Lower Usk) SSSI. The degree to which saltmarsh is sensitive to nutrient N deposition will depend upon it's successional stage with early stage of saltmarsh close to the intertidal mud being less sensitive than older, more species rich saltmarsh further from the tidal zone. However, the nutrient regime within all saltmarsh is dominated by the influence of the sea/river and therefore it is generally considered that, overall, such systems are not sensitive to nutrient N deposition.

Hedgerows

10.6.35 Hedgerows form the boundaries around a large number of fields within the assessment corridor. While evidence of direct impacts of nutrient N deposition on hedgerow species composition is lacking as the woody species present within a hedgerow are not considered particularly N sensitive, there is evidence that such inputs can have detrimental impacts on any lower plant communities that might be present on the hedgerow. However, APIS notes that the hedgerows within the Gwent Levels SSSIs are not susceptible to nutrient nitrogen deposition so it is also reasonable to assume that other such features outwith any of the designated sites along the assessment corridor are also not particularly sensitive. Therefore, no significant impacts to such habitats from nutrient nitrogen deposition are considered likely.

Conclusions

10.6.36 Whilst there would be increases in annual mean NO_x concentrations and nitrogen deposition at the designated sites assessed, no exceedences of the critical loads are predicted and exceedences of the precautionary annual mean NO_x objective are limited to only two of the eleven designated sites assessed, and then only within 20 m of the centre line of each carriageway and thus only a very small proportion of the designated site would be affected. Overall, the effect of the Scheme is considered to be 'not significant' for designated sites. Similarly for the habitats present along the corridor of the road, there would no significant effects as a result of NO_x concentrations.

10.6.37 With respect to nitrogen deposition, the critical loads of none of the habitats present along the corridor of the new section of motorway would be exceeded and there would be no significant effects.

10.7 Assessment of Land Take Effects

Proposed New Section of Motorway

10.7.1 In this section of this chapter the potential effects of the land take for the new section of motorway on each of the Ecological Units are identified and assessed, first, as required in Wales by DMRB Volume 11, Section 2, Part 5 - HA 205/08 (Highways Agency, 2008a), without mitigation, and then with mitigation in place. For the purposes of the assessment, as referred to above, certain measures are considered to be an integral part of the Scheme (embedded mitigation) and are thus included in the initial assessment of potential effects. The extents of the permanent and temporary land take for the Scheme are shown on Figure 2.16.

Designated Sites

European Statutory Designated Sites

10.7.2 The European Sites in the vicinity of the new section of motorway are shown on Figure 10.1. The only European site which would be affected by the land take for the new section of motorway would be the River Usk SAC. The east pier of the new crossing of the River Usk would be located within an area of saltmarsh on the east bank of the river avoiding the wetted channel of the river. The wetted channel has been defined through discussion with NRW as that part of the river channel below Mean High Water level as explained in Chapter 2: Scheme Description. The impacts of the new section of motorway on coastal saltmarsh as a feature of the River Usk (Lower Usk) SSSI and as a habitat *per se* are assessed later in this section.

10.7.3 The land take during construction of the pier would result in loss of a total area of 0.69ha of this saltmarsh vegetation. However following construction, much of the affected area would return to saltmarsh and the permanent land take would be 0.20 ha.

10.7.4 Whilst the 'footprint' of the new section of motorway would include the section of the River Usk beneath the bridge, there would be no actual land take within the river. However, the bridge would be located over the river and associated sub-tidal and intertidal habitats and the saltmarsh on the east bank. As shown on Figure 2.13b, the bridge deck would be approximately 30 m above the saltmarsh on the eastern bank of the Usk. The bridge would thus be sufficiently high for shading of the habitats within the River Usk SAC to be inconsequential.

10.7.5 To the extent that there may be effects on the River Usk SAC during the constructon and operation of the bridge these are assessed in Sections 10.8 and 10.9 below.

Assessment of Potential Effects

10.7.6 The mitigation included in the Scheme for this loss of saltmarsh is for the creation of new saltmarsh in an area to be used for construction of the River Usk Crossing once the construction works are complete. This area would also contain a lagoon to attenuate the flows of the bridge drainage before discharge to the River Usk. The saltmarsh creation would involve construction of a new floodbank around the area and adjusting the levels of the site to as appropriate to ensure flooding at spring tide levels. The finished site would thus need to lie between the level of Mean High Water and Mean High Water Springs, so between around 4.79 m to 6.39 m AoD.

10.7.7 Once at finished levels, the site would be allowed to revegetate naturally. This could take up to 10 years. The area of new saltmarsh on completion would extend to approximately 2 ha. The ratio of replacement habitat to the area permanently and temporarily lost within the designated site would thus be approximately 3:1. Considering only the area which would be permanently lost, the ratio of new saltmarsh to that lost within the designated site would be 10:1.

10.7.8 The River Usk east bank saltmarsh is within the River Usk SAC although it is not one of the features for which the SAC is designated. On this basis, there would be no loss of a key feature of the SAC and therefore the magnitude of the impact

of land take on the SAC (of International (Very High) value) is assessed as Negligible Adverse and the significance of effects as Slight at all timescales.

Assessment of Effects with Additional Mitigation

10.7.9 No additional mitigation is proposed and thus the magnitude of impact of the land take remain as Negligible Adverse and the significance of effects as Slight at all timescales.

National Statutory Designated Sites

10.7.10 The SSSIs in the vicinity of the new section of motorway are shown on Figure 10.2. The new section of motorway would cross the Gwent Levels, almost the whole of which is designated as a series of SSSIs. The Gwent Levels SSSIs which would be directly affected (from east to west) would be the St Bride's SSSI, the Nash and Goldcliff SSSI, the Whitson SSSI and the Redwick and Llandevenny SSSI. The new section of motorway would also cross the River Usk (Lower Usk) SSSI.

10.7.11 The east pier of the River Usk Crossing would be located within an area of saltmarsh on the east bank of the river avoiding the wetted channel of the river. The wetted channel has been defined through discussion with NRW as that part of the river channel below Mean High Water level as explained in Chapter 2: Scheme Description. At the location of the pier, the saltmarsh is largely dominated by tall sea couch grassland. The specific impacts of the new section of motorway on coastal saltmarsh are assessed later in this section. The land take during construction of the pier would result in loss of a total area of 0.69 ha of this saltmarsh vegetation. However following construction, much of the affected area would return to saltmarsh and the permanent land take would be 0.20 ha.

10.7.12 The mitigation included in the Scheme for this loss of saltmarsh is the creation of new saltmarsh in an area to be used for construction of the River Usk Crossing once the construction works are complete, as explained for the River Usk SAC above.

10.7.13 The total permanent land take within the Gwent Levels SSSIs would be some 105 ha, of which 35 ha would be to the west of the River Usk and 70 ha would be to the east. An additional 20 ha would be affected during construction (5.6 ha to the west of the River Usk and 14.4 ha to the east).

10.7.14 The Gwent Levels SSSIs are designated primarily for their reens and ditches, and the aquatic flora and fauna which they support, and for the shrill carder bee. As explained in Chapter 2: Scheme Description and the Reen Mitigation Strategy (Appendix 2.3), some 2568 m of reens and 9136 m of field ditches would be infilled or culverted. All of the existing reens crossed by the new section of motorway would be connected across the new motorway by culverts. The specific impacts of land take on these features are assessed later in this section.

10.7.15 The Reen Mitigation Strategy (Appendix 2.3) which has been agreed with NRW requires the replacement of all of the affected reens at a ratio of more than 1:1 and all field ditches at a ratio of more than 1:1. The actual length of new reen would be 2657 m and new field ditches 9771 m.

10.7.16 The new reens and ditches would quickly become colonised by aquatic vegetation and fauna from adjoining connected sections. This process could be accelerated by introduction of dredged material from high quality reens removed as part of the normal management programme.

10.7.17 The unmown ditch banks and rough grassland areas provide habitat for the shrill carder bee, as they contain the flowers preferred by the bee for sources of nectar and pollen, such as red clover, creeping thistle and black knapweed. Other than the ditch banks there is little species-rich grassland within the sections of SSSI which would be affected by the new section of motorway, most grassland being improved or semi-improved. To the extent that that there would be loss of habitat suitable for shrill carder bee, the landscape proposals shown on the EMP (Figure 2.6) include some 26.1 ha of species-rich grassland. The seed mix used in this grassland would be selected to include a range of food plants suitable for shrill carder bee across the species active period.

10.7.18 The permanent land take would result in the loss of 77.6 ha of grazing marsh (measured as grassland within the SSSIs within the land take of the Scheme) of which 25.3 ha would be to the west of Usk and 52.3 ha to the east.

Assessment of Potential Effects

10.7.19 As explained in Chapter 2: Scheme Description, the maintenance of reen connections by culverting across the road and the replacement of infilled and culverted reens and infilled field ditches at a ratio of greater than 1:1 is integral to the design of the Scheme. The landscape provision set out in the EMP (Figure 2.6) is also an integral part of the Scheme design. The extent of loss of saltmarsh within the River Usk (Lower Usk) SSSI and the mitigation comprising replacement habitat that is integral to the Scheme design have also been taken into account recognising that development of saltmarsh may take up to ten years following completion of the Scheme.

10.7.20 In the absence of additional mitigation, the magnitude of the impact of land take on the SSSIs (National (High) value) is assessed as Moderate Adverse and the significance of effect as Moderate or Large at all timescales.

Assessment of Effects with Additional Mitigation

10.7.21 The proposals for mitigation for the loss of grazing marsh within the SSSIs are set out in the SSSI Mitigation Strategy at Appendix 10.35. The mitigation proposed is the conversion of Maerdy Farm within the St Bride's SSSI to the west of the River Usk from arable farmland to permanent grassland. East of the Usk, the existing grassland and watercourses at Tatton Farm within the Nash and Goldcliff SSSI would be enhanced. At Caldicot Moor, within the Gwent Levels and outside, but adjacent to, the Magor and Undy SSSI, arable land would be converted to permanent grassland, existing grassland would be enhanced and former ditches which have been infilled would be reinstated.

10.7.22 Taking into account that this additional mitigation and enhancement would commence in advance of construction, and that improvements in the ecological interest of grasslands would be expected to be manifest within a few years (medium term), the magnitude of the land take impact on the Gwent Levels SSSIs (National (High) value) is assessed as Moderate Adverse and the significance of effect as Moderate or Large in the short term. In the medium to

long term, the magnitude of impact would be Minor Adverse and the Significance of effect would be Slight or Moderate.

Non-statutory Designated Sites

10.7.23 The non-statutory designated sites and ancient woodlands in the vicinity of the new section of motorway are shown on Figure 10.3. A number of non-statutory designated sites would be directly affected by the permanent land take for the new motorway. These are, from west to east, the Afon Ebbw River SINC, Marshall's SINC, Solutia Site SINC, Spencer Works 3 SINC, Bowkett Field, Barecroft SINC, Barecroft Fields SINC, Land at Barecroft Common SINC, Grange Road SINC, and Upper Grange Farm SINC. Ancient woodlands at Pwll Diwaelod and Berryhill Farm, both at the western end of the Scheme near Castleton would be affected by the land take for the new section of motorway. The proposed haul road from Ifton Quarry at the eastern end of the route would pass through ancient woodland at Rogiett Brake following a roadway previously constructed to transport stone used in construction of the Second Severn Crossing. The effects of land take on ancient woodland are considered later in this section under lowland mixed deciduous woodland (including wet woodland).

10.7.24 Each of the SINCs which would be affected is considered in turn.

10.7.25 Afon Ebbw River SINC. The designated site is confined to the channel of the river itself. The viaduct supports for the road over the river would be built on the edge of the channel. There would also be permanent drainage outfalls on the east and west banks of the river. There would be very minor incursion into the SINC. As shown on Figure 2.12, the height of the soffit of the Ebbw crossing above the saltmarsh on the west bank of the River Ebbw would be some 6.3 m. The clearance on the east bank would be less. This would result in shading of the river and associated intertidal habitats. This is unlikely to be of significance for the river and intertidal mud beneath the bridge, but would be significant for the adjoining saltmarsh and would be sufficient to reduce the growth of vegetation beneath the bridge.

10.7.26 Marshall's SINC. The designated site largely comprises the saltmarsh on the eastern bank of the River Usk together with a large pond and areas of industrial land. The effects on the saltmarsh have been described in the context of the River Usk SAC above. The motorway section of would continue eastwards on a viaduct and there would only be minor incursions into the SINC by the viaduct supports. However, there would be some additional temporary loss of SINC habitats during construction (see under Assessment of Construction Effects below).

10.7.27 Solutia Site SINC. The designated site is a series of improved and semi-improved grasslands with traditional ditches and ponds. The new section of motorway from chainage 11550 to 12350 would cut through the southern part of the SINC and Water Treatment Area 6 would be located in the south eastern part of the site. The total area lost from the SINC would be some 12.7 ha out of a total area of 64.4 ha and a further 6.03 ha would be severed from the remainder to the south of the new section of motorway.

10.7.28 Spencer Works 3 SINC. This site is located in the Tata Lagoons area and is designated for marshy grassland with wet drains. The new section of motorway

from chainage 15700 to 16300 would remove a series of embankments and drains forming the southern part of the site.

10.7.29 Bowkett Field, Barecroft SINC; Barecroft Fields SINC; and the Land at Barecroft Common SINC in the Bareland Street area are adjoining fields, which together form a continuous block of some 13.1 ha.

10.7.30 Bowkett Field, Barecroft SINC. This is a large, linear, flat field which comprises tall swamp/marshy grassland. Around the field margins, the reens, particularly on the eastern edge, support mature willow scrub, and host many bird species. A small piece of land at the entrance to the site (in the north) comprises overgrown willow scrub.

10.7.31 Barecroft Fields SINC. This is formed of two large, flat fields, comprising semi-improved, relatively species-poor damp grassland/wet pasture.

10.7.32 Land at Barecroft Common SINC. This comprises three large, flat fields on the Gwent Levels at Magor: All fields comprise semi-improved damp grassland, which is ungrazed/uncut and with a sward height of 70 cm – 100 cm. The reens adjacent to the field support aquatic species.

10.7.33 The new section of motorway from chainage 19600 to 19800 would cut through the north west corners of Bowkett Field, Barecroft SINC and Barecroft Fields SINC, and a very small section of Land at Barecroft Common SINC.

10.7.34 Grange Road SINC. This is formed of two fields, including a flat low lying field with a watercourse and a gentle to moderately sloping field towards the east of the site. The site includes an unmodified stream that runs north to south along the western boundary of the site. The fields include species-rich neutral grassland on the steeper slopes to the east of the site and semi-improved neutral grassland between the more diverse slope and the stream to the east. The new section of motorway from chainage 21300 to 21580 would skirt the northern edge with some loss of the designated site. The drainage outfall pipe from Water Treatment Area 11b would be installed across the westernmost field to a headwall at the discharge point into St Bride's Brook (also referred to as Mill Reen).

10.7.35 Upper Grange Farm SINC. This is a species-rich grassy bank comprising some areas of rank, tussocky grass. This bank forms the south eastern boundary of a larger field comprising improved grassland. The new section of motorway from chainage 21250 to 21300 would skirt the southern edge with some loss of the designated site. Works to the St Bride's Underbridge on the approach to the structure may also affect the western edge of the site.

Assessment of Potential Effects

10.7.36 Much of the loss of areas designated as SINCs (receptor of County (Medium) value) would comprise grasslands. As explained in Section 10.5, the landscape provision set out in the EMP (Figure 2.6) is part of the Scheme design. This would provide extensive areas of grassland vegetation, including 26.1 ha of species-rich grassland and 13.4 ha of marsh and wet grassland. There would also be shading effects of that section of the River Ebbw SINC beneath the Ebbw crossing.

10.7.37 In the absence of other mitigation, the magnitude of the loss of SINCs (County (Medium) value) is assessed as Major Adverse and the significance of effect as Moderate or Large at all timescales.

Assessment of Effects with Additional Mitigation

10.7.38 The proposals for additional mitigation for the loss of grazing marsh are set out in the SSSI Mitigation Strategy at Appendix 10.35 and referred to under Statutory Designated Sites above. To the extent that this would result in creation of new grassland areas and improved management of existing grasslands, this would also serve to mitigate for the loss of areas of SINCs.

10.7.39 Taking into account that this additional mitigation and enhancement would commence in advance of construction, and that improvements in the ecological interest of grasslands would be expected to be manifest within a few years (medium term), the magnitude of the land take impact on the SINCs (County (Medium) value) is assessed as Major Adverse and the significance of effect as Moderate or Large in the short term. This would reduce to a magnitude of impact of Moderate Adverse and a significance of effect of Moderate in the medium/long term.

Nature Reserves

10.7.40 The nature reserves in the vicinity of the new section of motorway are the Newport Wetlands NNR and RSPB Nature Reserve, and the Magor Marsh and Great Traston Meadows Gwent Wildlife Trust Nature Reserves. The new section of motorway would not result in land take from any of these nature reserves.

Rivers (Usk and Ebbw)

10.7.41 The Rivers (Usk and Ebbw) Ecological Unit includes the following VERS.

- Rivers.
- Sub-tidal benthic habitat.
- Intertidal mudflats.
- Coastal saltmarsh.
- Migratory fish.
- Estuarine fish assemblage.

10.7.42 The overall impacts of the land take for the new section of motorway on the Ecological Unit are described first with a description of the mitigation that is included in the design of the Scheme. Then the impacts on each of the relevant VERs are assessed.

10.7.43 As explained in Section 10.5, the crossings of the Rivers Usk and Ebbw have been designed so that all permanent and temporary works would be outside the wetted channel (defined as below Mean High Water as explained in Chapter 2: Scheme Description). There would thus be no incursion into the rivers themselves. Thus for the Rivers, Sub-tidal benthic habitat, and Intertidal mudflats habitats VERs the magnitude of the impact would be No change and the significance Neutral. There is no requirement for any additional mitigation.

10.7.44 Similarly for the Migratory fish and Estuarine fish assemblage VERs the magnitude of the impact would be No change and the significance Neutral. There is no requirement for any additional mitigation.

10.7.45 Only the coastal saltmarsh VER requires further consideration here.

Coastal Saltmarsh

10.7.46 The East Pier of the River Usk Crossing would be located within saltmarsh on the east bank of the River Usk. As explained for the River Usk SAC earlier in this section, the land take during construction of the pier would result in loss of a total area of 0.69 ha of this saltmarsh vegetation. Following construction, much of the affected area would return to saltmarsh and the permanent land take would be 0.20 ha.

10.7.47 The east and west supports of the River Ebbw Underbridge would also be located within saltmarsh. During construction, the area affected would be 0.74 ha. Following completion some of the affected area would return to saltmarsh but as shown on Figure 2.12, the height of the soffit of the Ebbw crossing above the saltmarsh on the west bank of the River Ebbw would be some 6.3 m. The clearance on the east bank would be less. This would result in shading of the saltmarsh and would be sufficient to reduce the growth of vegetation beneath the bridge. So on a precautionary basis it is assumed that all of this saltmarsh would be permanently lost.

10.7.48 The River Usk saltmarsh is a feature of the River Usk (Lower Usk) SSSI and is valued as National (High). The River Ebbw saltmarsh is part of the River Ebbw SINC and is valued as County (Medium).

Assessment of Potential Effects

10.7.49 As explained in Section 10.5, the proposed mitigation which is integral to the Scheme for the loss of saltmarsh is the creation of a new area of saltmarsh in an area to be used for construction of the River Usk Crossing once the works are complete.

10.7.50 The total permanent loss of saltmarsh at the Rivers Usk and Ebbw would be 0.94 ha. The area of new saltmarsh on completion would extend to approximately 2 ha. The ratio of replacement habitat to the area permanently lost would thus be approximately 2.1:1.

10.7.51 On this basis the magnitude of the impact on coastal saltmarsh of land take, taking into account this mitigation that is integral to the Scheme, and that development of saltmarsh may take up to ten years following completion of construction, is assessed as Minor Adverse in the medium term. This would lead to an effect of Slight or Moderate significance for the River Usk saltmarsh (National (High) value) and Slight significance for the River Ebbw saltmarsh (County (Medium) value). In the long term the magnitude of impacts would be Negligible and the significance of effects would be Slight for the River Usk saltmarsh (National (High) value) and Neutral or Slight for the River Ebbw saltmarsh (County (Medium) value).

Assessment of Effects with Additional Mitigation

10.7.52 No additional mitigation is proposed. On this basis the magnitude of the land take would remain as Minor Adverse in the medium term, leading to an effect of Slight or Moderate significance for the River Usk saltmarsh (National (High) value) and Slight significance for the River Ebbw saltmarsh (County (Medium) value). In the long term the magnitude of impacts would be Negligible and the significance of effects would be Slight for the River Usk saltmarsh (National (High) value) and Neutral or Slight for the River Ebbw saltmarsh (County (Medium) value).`

Reens, Ditches, Reedbeds and Ponds

10.7.53 The Reens, ditches, reedbeds and ponds Ecological Unit includes the following VERS.

- Eutrophic standing waters.
- Ponds.
- Reedbeds.
- Aquatic macrophytes.
- Otter.
- Water vole.
- Grass snake.
- Great crested newt and other amphibians.
- Freshwater fish assemblage.
- Freshwater invertebrates.

10.7.54 The overall impacts of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme. Then the impacts on each of the relevant VERs is assessed.

10.7.55 A total of 2568 m of reens and 9136 m of field ditches would be infilled or culverted during the construction of the new section of motorway. This is described in Chapter 16: Road Drainage and the Water Environment and in the Reen Mitigation Strategy (Appendix 2.3). The Gwent Levels as a whole contain a total of 229 km of reens (including main rivers) and 1400 km of field ditches. The extent of loss thus amounts to some 1.1% of reens and 0.6% of field ditches.

10.7.56 The lost reens and field ditches would be replaced with 2657 m of reens and 9771 m of field ditches across the Levels. This would ensure that there was no reduction in the extent of the freshwater ecosystem which is the basis of much of the interest of the Gwent Levels SSSIs. In addition, the provision of berms within the replacement reens, and the lack of shading hedgerows, would provide enhanced opportunities for growth of aquatic macrophytes compared to some of the reens which they would replace. This would in turn encourage greater diversity of aquatic invertebrates. Once created, the new reens would be managed in rotation by NRW and the ditches by the landowners.

10.7.57 The hydrology of the reen system would be maintained across the line of the new road by culverting. However, culverting inevitably alters the ecological

characteristics of a watercourse. Culverting results in shading of the watercourse and therefore limits macrophyte growth, causes disturbance to the substrate of the watercourse and changes to the resulting substrate depth and composition post-installation, and affects flow characteristics upstream and downstream of the culvert.

10.7.58 Culverts would be relatively large box culverts (1800 mm in height by 1800 mm in width, or as otherwise required in response to findings of hydrological analysis). Each culvert would be provided with an adjacent separate dry underpass of 900 mm diameter at a high enough level to be above the summer penning level. Mitigation would also include the construction of dry mammal crossings along the new section of motorway route shown on the Environmental Masterplan (EMP) (Figure 2.6).

10.7.59 The construction of culverts and installation of mammal fencing would be undertaken during the first 8 months of the works on the Caldicot Levels and the first 9 months on the Wentlooge Levels (Appendix 3.1: Buildability Report). Mammal crossings would be constructed as soon as practicable during construction of the road formation.

10.7.60 Construction and operational mammal fencing would be installed to guide mammals into culverts, dry underpasses and mammal crossings.

10.7.61 Bridges would be constructed across the River Ebbw and River Usk, thereby ensuring the retention of river and bank habitat and access to riverine habitats to the north and south of the new road.

10.7.62 Ponds are defined as waterbodies that are 2 ha in size or smaller. No ponds would be lost under the footprint of the new section of motorway itself but a pond would be lost at the Duffryn construction compound site.

10.7.63 A total of 6.59 ha of reedbed would be affected during the construction of the new section of motorway of which 3.19 ha would be taken for the permanent works and 3.35 ha would be temporarily used during the construction period and then returned to reedbed.

10.7.64 As described in Chapter 2: Scheme Description, water treatment areas including ponds and reedbeds would be constructed along the length of the route, 9.4 ha of which would comprise ponds and 8.06 ha of which would comprise reedbeds.

Eutrophic Standing Waters

10.7.65 The strategy for replacing reens and field ditches as part of the new section of motorway is set out in the Reen Mitigation Strategy (Appendix 2.3) and is summarised above.

Assessment of Potential Effects

10.7.66 The magnitude of impacts from land take on Eutrophic Standing Waters (receptor of National (High) value) taking into account the mitigation included in the Scheme comprising the replacement of reens and field ditches which would be undertaken early in the construction programme is assessed as Negligible Adverse and the significance of effects as Slight in the short term.

Assessment of Effects with Additional Mitigation

10.7.67 No additional mitigation is proposed. Thus the magnitude of impacts from land take on Eutrophic Standing Waters would remain as Negligible Adverse and the significance of effects as Slight.

Ponds

10.7.68 The extent of loss of pond habitat and the proposed mitigation are described above.

Assessment of Potential Effects

10.7.69 The magnitude of impacts from land take on Ponds (receptor of County (Medium) value) taking into account the pond creation associated with the water treatment areas included in the Scheme (shown on the EMP at Figure 2.6) is assessed as Minor Adverse and the significance of effects as Slight in the short term. In the medium term the magnitude of impacts would be Negligible Adverse and the significance of effects would be Neutral or Slight. In the longer term the impacts would be Minor Beneficial and the significance of effects would be Slight.

Assessment of Effects with Additional Mitigation

10.7.70 No additional mitigation is proposed thus the magnitude of impacts from land take on Ponds would remain as Minor Adverse and the significance of effects as Slight in the short term. In the medium term the magnitude of impacts would be Negligible Adverse and the significance of effects would be Neutral or Slight. In the longer term the impacts would be Minor Beneficial and the significance of effects would be Slight.

Reedbeds

10.7.71 The extent of reedbed loss and replacement as part of the Scheme is described above.

Assessment of Potential Effects

10.7.72 The magnitude of impacts from land take on Reedbeds (receptors of County (Medium) value) taking into account the reedbed creation associated with the water treatment areas included in the Scheme (shown on the EMP at Figure 2.6) is assessed as Moderate Adverse and the significance of effects as Moderate in the short term. In the medium term as the new reedbeds establish, the magnitude would be Negligible and the significance of effects would be Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.7.73 No additional mitigation is proposed, thus the magnitude of impacts from land take on Reedbeds would remain as Moderate Adverse and the significance of effects as Moderate in the short term. In the medium term as the new reedbeds establish, the magnitude of impact would be Negligible and the significance of effects would be Neutral or Slight.

Aquatic Macrophytes

10.7.74 The extent of loss and mitigation for loss of freshwater habitats is described above. Individual notable species which would be affected would be as follows.

- Rootless duckweed which is nationally rare and was found along a 5 m length of the Morfa Gronw Reen. This species is listed as Vulnerable in the Vascular Plant Red Data Book for Great Britain (Cheffing and Farrell, 2005).
- Tubular water-dropwort, which is widespread within the Gwent Levels although it is nationally rare and declining.
- Hairlike pondweed, which is nationally rare but abundant within the Gwent Levels.
- Narrow leaved water-plantain which is a nationally rare species and was found during the aquatic macrophytes survey (Appendix 10.30) to be also rare within the Gwent Levels.
- Frogbit is a nationally rare and declining species but was found to be common within the Gwent Levels.
- Cyperus sedge is rare and declining in Wales and is uncommon within the Gwent Levels.
- Flowering rush is rare and declining in Wales and is uncommon within the Gwent Levels.

Assessment of Potential Effects

10.7.75 The assessment of the impacts of habitat loss on the aquatic macrophyte assemblage (receptor of National (High) value) takes into account the overall availability of habitat across the Gwent Levels, and the extent of replacement of reens and ditches that is integral to the Scheme and would be implemented in the early stages of the construction. The magnitude of impact is assessed as Minor Adverse and the significance of effect as Slight or Moderate in the short term. In the medium term the magnitude of impact is assessed as Negligible and the significance of effect as Slight.

Assessment of Effects with Additional Mitigation

10.7.76 Where practicable and subject to NRW approval, plant material from existing reens and ditches which would be lost, and also material arising from NRW dredging of watercourses would be used to encourage colonisation of new reens and ditches by aquatic macrophytes. Taking into account this additional mitigation the magnitude of the impact of the loss of habitat on the aquatic macrophyte assemblage and (receptor of National (High) value) is assessed as Negligible Adverse and the significance of effect as Slight in the short term.

Otter

10.7.77 Taking into account results of the 2014 and 2015 otter survey (Appendices 10.8 and 10.25), the new section of motorway working corridor would cross ten watercourses, where signs of otter activity have been recorded. These watercourses include the River Usk and River Ebbw; two reens (Percoed Reen, Coedkernew, and Middle Road Reen on the Tata Steel site); two main drains on the Tata Steel site (including Monk's Ditch); and one stream to the north of the

existing M4 and Magor. In addition, the works area would be located adjacent to two watercourses where otter activity has been recorded; Nant y Moor Reen, to the south of Imperial Park and east of Coedkernew, and a ditch to the south of Rush Wall track to the south of Llandevenny and the A4810.

10.7.78 The stream to the north of the existing M4 and Magor at the eastern end of the route, where signs of otter activity have been recorded in 2014 and 2015 (Appendices 10.8 and 10.25) is currently culverted and would remain culverted, so as to enable continued movement of otters and other species.

10.7.79 The strategy for replacement of reens and ditches, and provision of culverts and dry mammal crossings across the line of the road, and mammal fencing along the new section of motorway, is described above.

10.7.80 Otters also utilise terrestrial habitat for foraging, commuting and resting, such as woodland, scrub and hedgerows, particularly where associated with watercourses. The extent of loss and replacement of these habitats is described under Farmland later in this section.

10.7.81 No confirmed otter holts have been located during surveys to date; however, a possible location for a holt has been indicated by NRW in an area of scrub to the east of the River Ebbw. The site is not located within the footprint of the new section of motorway and would not be lost due to construction of the new road.

Assessment of Potential Effects

10.7.82 The assessment considers the number of reens and watercourses that would be culverted or bridged, and taking into account the area of replacement reedbeds and other water treatment areas, and the area of terrestrial habitat creation, and the number of unaffected watercourses/waterbodies and terrestrial habitat in the surrounding area. The magnitude of the impact of habitat loss (temporary and permanent) on the local otter population (a receptor of National (High) value) is assessed as Minor Adverse and the significance of effect as Slight or Moderate at all timescales due to the lack of mammal crossings and the potential for culverts to be flooded thereby potentially preventing otters from crossing the line of the road and accessing habitat.

Assessment of Effects with Additional Mitigation

10.7.83 Taking into account the additional mitigation comprising the provision of mammal crossings and the sympathetic design of box culverts with associated dry mammal tunnels, and the detailed alignment of fencing in order to guide otters into culverts and crossing points, the magnitude of the impact of habitat loss on otters is assessed as Negligible Adverse and of the significance of effect as Slight at all timescales.

Water Vole

10.7.84 Taking into account results of the 2014 and 2015 water vole surveys (Appendices 10.8 and 10.25), the new section of motorway would result in the loss of 21 watercourses/sections of watercourses and two waterbodies (one pond located to the east of Coedkernew and south of Imperial Park, and one reedbed on the Tata Steel site) where signs of water vole activity were recorded in 2014 and/or 2015. In addition, 14 watercourses where signs of water vole activity were recorded in 2014 and/or 2015 are at risk of damage or habitat loss during construction due to

their proximity to working areas (i.e. they are located immediately adjacent to or along the boundary of working areas). Signs of water vole activity were also recorded in reedbeds on the Tata Steel site, some of which would be lost during construction.

10.7.85 Due to the mobile nature of water voles, the final number/sections of watercourses and waterbodies, including reedbeds, that are inhabited by water voles and that would be lost during construction would be determined through pre-construction surveys.

10.7.86 The strategy for replacement of reens and ditches is described in the Reen Mitigation Strategy (Appendix 2.3) and summarised above.

10.7.87 Water voles are known to utilise relatively short culverts, e.g. in order to cross single carriageways (Strachan *et al.* 2011). Therefore, in order to take into account the width of the new section of motorway and to maximise their potential for use by water voles, thereby minimising the potential impact of habitat loss by providing access to habitat to the north and south of the new road, culverts would be relatively large box culverts (1800 mm in height by 1800 mm in width, or as otherwise required in response to findings of hydrological analysis). Each culvert would be provided with an adjacent separate dry underpass of 900 mm diameter at a high enough level to be above the summer penning level.

10.7.88 In order to help ensure new and replacement wetland habitats (reens, ditches, water treatment areas and reedbeds) are favourable to water voles, the mitigation strategy would ensure habitats incorporate features of potential value to water voles, including good vegetative cover across banks, berms in reens at high water level and banks suitable for burrowing (as shown on the EMP (Figure 2.6) and Reen Mitigation Strategy (Appendix 2.3). Where water voles need to be translocated to new watercourses prior to construction (see Section 10.8), measures would be set in place so as to ensure receptor sites are established and favourable to water voles prior to displacement or translocation. These receptor sites would be located within the SSSI mitigation areas (Appendix 10.35) or elsewhere by agreement.

Assessment of Potential Effects

10.7.89 The assessment takes into account the total length of reens and field ditches and area of waterbodies, including reedbeds, that would be lost as part of the new section of motorway, and the replacement and additional watercourses (reens and ditches), and waterbodies and reedbeds in the water treatment areas, that would be constructed providing suitable habitat for water voles. The magnitude of the impact of habitat loss (temporary and permanent) on the local water vole population (a receptor of County (Medium) value) is assessed as Moderate Adverse and of the significance of effect as Moderate in the short term. In the medium and long term as the new habitats developed the magnitude of impacts is assessed as Minor Adverse and the significance of effects as Slight.

Assessment of Effects with Additional Mitigation

10.7.90 Taking into account the sympathetic design of culverts and measures to enhance existing watercourses in the SSSI mitigation areas (see Appendix 10.35) for the benefit of translocated water voles, the magnitude of the impact of land take on water vole (County (Medium) value) is assessed as Minor Adverse and the

significance of effect as Slight significance in the short term. In the medium and long term the magnitude of impact is assessed as Negligible and the significance of effect as Neutral or Slight.

Grass Snake

10.7.91 The extent of loss and strategy to replace reens and ditches and other wetland areas is described in the Reen Mitigation Strategy (Appendix 2.3) and summarised above.

10.7.92 Measures to locate and protect or relocate features of potential value as egg-laying sites (e.g. piles of decomposing organic material, such as leaf litter, grass clippings or manure) and hibernation sites (including piles of rubble or other debris) are described under construction effects below.

Assessment of Potential Effects

10.7.93 Taking into account the total length of reens and watercourses and area of waterbodies, including reedbeds that would be lost as part of the Scheme, the replacement of reens and ditches and provision of culverts at reen crossings, as well as landscape proposals including the creation of water treatment areas and replacement reedbeds shown on the EMP (Figure 2.6), the magnitude of the impact of habitat loss on the local grass snake population (a receptor of County (Medium) value) is assessed as Moderate Adverse and the significance of effect as Moderate in the short term. In the medium and long term the magnitude of impact is assessed as Minor Adverse and the significance of effect as Slight.

Assessment of Effects with Additional Mitigation

10.7.94 Taking into account the additional mitigation set out in the SSSI Mitigation Strategy (Appendix 10.35) which would commence early in the construction programme and which would improve reen, ditch and grassland habitat for grass snake, the magnitude of the impact on the local grass snake population would be Minor Adverse and the significance of effects would be Slight in the short term. In the medium and long term the magnitude of impacts would be Negligible and the significance of effects would be Neutral or Slight.

Great Crested Newt and Other Amphibians

10.7.95 Taking into account the results of the 2015 great crested newt eDNA analysis (shown on Figure 10.8 and described in Appendix 10.22), and the results of the great crested new presence/absence survey carried out in 2014 (Appendix 10.6) the new section of motorway would not result in the direct loss of any watercourses known to be inhabited by great crested newts.

10.7.96 Further presence/absence surveys will be undertaken in 2016 to further investigate the presence of great crested newts in the areas around the positive eDNA results. This would inform the method statement for any European Protected Species licence which may be required for disturbance of great crested newt. This survey will take into account that great crested newts typically disperse up to 250 m from breeding sites (English Nature 2001).

10.7.97 Approximately 15 watercourses located within 250 m of watercourses where positive eDNA results were recorded in 2015 (Figure 10.8) are also located within the footprint of the new section of motorway and, therefore, would be infilled

during construction. In addition, six watercourses located within 250 m of watercourses where positive eDNA results were recorded in 2015 are located along the boundaries of the footprint of the new section of motorway and, therefore, could be affected.

10.7.98 The length of watercourses to be lost equates to approximately 1,970 m within 250 m of a watercourse in which great crested newt eDNA was recorded in 2015.

10.7.99 However, it should be noted that the A4810 could act as a barrier to the movement of newts from the two eastern-most watercourses where great crested newt eDNA was recorded in 2015 (Figure 10.8) and the watercourses located to the south of the A4810 and within the footprint of the new section of motorway. Therefore, the loss of these watercourses may not have a significant ecological impact on the local great crested newt population.

10.7.100 The extent of loss and replacement of reens and ditches and other wetland areas as part of the Scheme is described above.

10.7.101 In order to enhance replacement or additional aquatic habitat features for the benefit of great crested newts, mitigation would include ecological input to the design of replacement habitat, including profiling and planting so as to be of benefit to newts.

10.7.102 Great crested newts were also recorded in areas of rough grass and scrub associated with reedbeds, swamps and watercourses on the Tata Steel site in 2015 (Figure 10.8). Terrestrial habitat replacement would be undertaken as part of the Scheme in accordance with the EMP (Figure 2.6). Landscape proposals for the whole of the Scheme, shown in the EMP, would include 7.06 ha of scrub planting; 83.1 ha of woodland and 19.8 ha of linear belt planting (to mitigate the loss of 7.15 ha of semi-natural woodland and 42.59 ha of plantation); 27.9 ha of the new woodland and 16.4 ha of linear belts would be to the east of the Usk; 9.86 ha of new reedbeds (to mitigate the loss of 6.59 ha of reedbed); and 117 ha of new grassland.

Assessment of Potential Effects

10.7.103 The assessment takes into account that wetland and terrestrial habitat of known or potential value to great crested newts and other amphibians would be lost as part of the Scheme, and considers the fact that no waterbodies where great crested newt eDNA has been recorded would be lost to construction, the availability of alternative existing habitat, and the new reens and ditches, water treatment areas including ponds and areas of reedbed, scrub and tree planting, and rough or meadow grassland that would be created as part of the Scheme (as shown on the EMP at Figure 2.6). The magnitude of the impact of habitat loss (temporary and permanent) without mitigation on the local great crested newt population (a receptor of County (Medium) value) is assessed as Minor Adverse and significance of the effect as Slight in the short term. In the medium and long term as the new habitats develop the magnitude of the impact is assessed as Negligible Adverse and the significance of the effect as Neutral or Slight.

10.7.104 For other amphibians (District (Low) value) the magnitude of the impact of habitat loss is assessed as Minor Adverse and significance of the effect as Neutral or Slight in the short term. In the medium and long term as the new habitats develop the magnitude of the impact is assessed as Negligible Adverse and the significance of the effect as Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.7.105 No additional mitigation is proposed for great crested newt and thus the magnitude of the impact would remain as Minor Adverse and the significance of the effect Slight in the short term. In the medium and long term, as the new habitats develop, the magnitude of the impact is assessed as Negligible Adverse and the significance of the effect as Neutral or Slight.

10.7.106 For other amphibians (District (Low) value) the magnitude of the impact of habitat loss would remain as Minor Adverse and significance of the effect as Neutral or Slight in the short term. In the medium and long term as the new habitats develop the magnitude of the impact is assessed as Negligible Adverse and the significance of the effect as Neutral or Slight.

Freshwater Fish Assemblage

10.7.107 The extent of loss of reens and ditches and the strategy for replacement is described in the Reen Mitigation Strategy (Appendix 2.3) and summarised above.

10.7.108 Recognising that the eels which occur in the reens and ditches of the Gwent Levels are part of the population which is one of the reasons for notification of the Severn Estuary Ramsar Site, then this population should be considered to be of International (Very high) value. Given the diversity of the fish populations in some of the other watercourses and the extent of freshwater habitat, then these should be considered to be of County (Medium) value.

Assessment of Potential Effects

10.7.109 The magnitude of the impacts of habitat loss on the freshwater fish assemblage (receptor of County (Medium) value), taking into account the extent of replacement of these features and maintenance of connectivity of watercourses which forms part of the Scheme and the overall availability of habitat across the Gwent Levels is assessed as Minor Adverse and the significance of effects as Slight at all timescales. For European eel, the population of which is of International (Very High) value the significance of effects would be Slight or Moderate at all timescales.

Assessment of Effects with Additional Mitigation

10.7.110 No additional mitigation is proposed for fish generally, but it is proposed that eel passes would be provided on all new sluices and similar structures constructed as part of the Scheme. Thus the magnitude of the impact of the loss of habitat for the freshwater fish assemblage (receptor of County (Medium) value) would remain as Minor Adverse and the significance of effects as Slight. For European eel (International (Very high) value) the magnitude of impact would reduce to Negligible and the significance to Slight at all timescales.

Freshwater Invertebrates

10.7.111 The extent of loss and strategy for replacement of freshwater habitats is described in the Reen Mitigation Strategy (Appendix 2.3) and summarised above. As described in Chapter 2: Scheme Description, water treatment areas with ponds and reedbeds would be constructed along the length of the new section of motorway.

10.7.112 As explained in Section 10.4, the invertebrate assemblage and species found in the reens and ditches are one of the interest features of the Gwent Levels SSSIs and are dependent on the continued management of the drainage system. The improved profile of the replacement reens and the absence of shading hedgerows would encourage a diversity of aquatic macrophytes, and in turn benefit the aquatic invertebrate community.

Assessment of Potential Effects

10.7.113 The magnitude of the impacts of habitat loss on the freshwater invertebrate assemblage (receptor of National (High) value) taking into account the measures for replacement of reens and ditches, and creation of water treatment areas containing ponds and reedbeds, and the overall availability of habitat across the Gwent Levels, is assessed as Minor Adverse and the significance as Slight or Moderate in the short term. In the medium and long term, as the new habitats establish, the magnitude of impact is assessed as Negligible Adverse and the significance of the effects as Slight.

Assessment of Effects with Additional Mitigation

10.7.114 No additional mitigation is proposed and the magnitude of impacts would remain as Minor Adverse and the significance as Slight or Moderate in the short term. In the medium and long term, as the new habitats establish, the magnitude of impacts would remain as Negligible Adverse and the significance of effects as Slight.

Grazing Marsh

10.7.115 The Grazing marsh Ecological Unit includes the following VERS:

- Coastal and floodplain grazing marsh.
- Shrill Carder bee.
- Wet grassland plants.

10.7.116 The overall impacts of the land take for the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme and then the additional mitigation proposed. Then the impacts on each of the relevant VERs is assessed.

10.7.117 The sections of the new section of motorway from Church Lane in Coedkernew (chainage 4600) to the River Ebbw (chainage 8400) and then from the railway line to the east of Newport Docks (chainage 11400) to the railway line at Magor (chainage 20100) are within the Gwent Levels. Much of these sections of the route are within the series of Gwent Levels SSSIs. The grazing marsh of the Levels includes the reens and ditches which support the aquatic plants and invertebrates, and the shrill carder bee, which are the key features for which the SSSIs are notified.

10.7.118 The population of shrill carder bee within the Gwent Levels is one of the reasons for notification of the Gwent Levels SSSIs. The bumblebee survey carried out for the Scheme in 2015 focussed on this species and on the Brown-banded carder bee. The great majority of the populations of both target species occurred on or south of the proposed route of the new road. Although they were found across the whole of the survey area, records were noticeably clumped in areas of floral

diversity and abundance. Ungrazed open areas such as the Tata Steel land seem to be important in providing a greater diversity of floral resources. Hedgerows and reens were important where pasture was improved or semi-improved. As well as across the Levels, both these bee species were also found in areas of industrial land at Newport Docks and within the Tata Steel site.

10.7.119 The effects of land take on the aquatic macrophytes associated with the reens and ditches of the Levels have been assessed earlier in this section. In addition to these aquatic species, a number of notable wet grassland species were recorded in the NVC surveys carried out along the new section of motorway corridor in 2014 and 2015.

10.7.120 The majority of the grassland included within the study area is managed as permanent pasture and has fairly low botanical diversity. A few of the species in these grasslands are considered locally significant, such as Meadow Brome and Meadow Barley. In some areas there are patches of more botanical interest within fields, for example orchids and corky-fruited water-dropwort at Broad Street Common, or tubular water-dropwort in the field grips at New Dairy Farm. The damp field grips at Whitecross Farm and Tatton Farm support tubular water-dropwort.

10.7.121 The most diverse examples of damp grassland are at Greenmoor Lane with notable species including meadow thistle, meadow rue, purple moor-grass and brown sedge.

Coastal and Floodplain Grazing Marsh

10.7.122 The vegetation cover of the Levels is predominantly grassland with some arable fields. The majority of the grassland is managed as permanent pasture, some of which is left ungrazed during the spring to provide a hay crop. Grazing is mostly by cattle, but some fields have sheep or horses, and it generally has a fairly low botanical diversity, although in some areas there are patches of more botanical interest within fields. For the purposes of assessment, all of the grassland within the SSSIs has been considered to be grazing marsh.

10.7.123 On this basis the total loss of grazing marsh as a result of the land take for construction and for the permanent works would be 86.4 ha (of which 77.6 ha would be permanently lost and 8.85 ha would be within the temporary construction areas).

Assessment of Potential Effects

10.7.124 The Gwent Levels SSSIs in total cover some 5800 ha, the majority of which is grazing marsh. The loss of 86.4 ha therefore represents some 1.5% of the total area.

10.7.125 Taking into account the extent of the loss of grazing marsh habitat, the magnitude of the impact of land take on grazing marsh habitat (of National (High) value) would be Moderate Adverse and the significance of effect would be Moderate or Large at all timescales.

Assessment of Effects with Additional Mitigation

10.7.126 The strategy to mitigate the effects of loss of grazing marsh is described in the SSSI Mitigation Strategy (Appendix 10.35). A total of some 86 ha of grazing

marsh would be affected a result of the permanent and temporary land take within the Gwent Levels SSSIs of which some 78 ha would be permanently lost. Three proposed mitigation areas have been identified at Maerdy Farm to the west of the River Ebbw and Tatton Farm and Caldicot Moor to the east of the River Usk. The actual land requirements are to be agreed with NRW but the total areas of these mitigation areas are as follows.

- Maerdy Farm - 24.33 ha.
- Tatton Farm - 17.34 ha.
- Caldicot Moor - 113.28 ha.

10.7.127 The strategy sets out the measures which would be implemented within these areas. Those relevant to the grazing marsh habitat itself comprise the following.

- Continue the current NRW water level management regimes.
- Enhance the biodiversity value of existing watercourses through measures including:
  - rotational clearance/casting of silt and leaf litter, and thinning of aquatic vegetation.
  - re-profiling of banks.
  - removal and/or coppicing of hedgerows and scrub along the banks of watercourses.
  - management of scrub along the banks of watercourses.
  - potential spreading over banks of watercourses, soils taken from banks of watercourses known to contain a rich diversity of plant species.
  - clearance and control of invasive plant species.
- Increase the amount of habitat of potential value to aquatic/semi-aquatic plants and insects by:
  - re-creating historic ditches and grips; and
  - creating scrapes.
- Enhance the plant species diversity in existing grassland fields by for example spreading green hay, slot seeding.
- Increase the area of species diverse grassland in the SSSI through arable reversion.
- Create additional areas of species diverse grassland outside the Gwent Level SSSI through arable reversion and grassland enhancement measures.

10.7.128 Taking into account the measures set out in this strategy once implemented and which would commence in the early stages of the Scheme, the magnitude of the impact of land take on grazing marsh habitat (of National (High) value) would be Moderate Adverse and the significance of effect would be Moderate or Large in the short term. In the medium and long term as the improvement in the SSSI mitigation areas take effect, the magnitude of impact is assessed as Minor Adverse and the significance of effect as Slight or Moderate.

Shrill Carder Bee

10.7.129 Loss of habitat for shrill carder bee would arise from the loss of the vegetation bordering reens and ditches, and the loss of vegetated brownfield land at Great Pencarn, land within Newport Docks and the Tata Steel site. As explained in Section 10.5, mitigation for the loss of reens and ditches is described in the Reen Mitigation Strategy (Appendix 2.3).

10.7.130 The EMP (Figure 2.6) shows that the south facing embankments and cuttings of the new section of motorway would include areas to be sown to species-rich grassland. Extensive areas of species-rich grassland would be established on south facing cutting slopes at the Castleton Interchange in the west of the route and on the embankments of water treatment areas. In all some 26.1 ha of species rich grassland would be established as part of the landscape proposals included in the Scheme. The seed mix for this grassland would take into account the specific needs of shrill carder bee and would include a range of food plants used by the species such as common knapweed, scabious, red clover, bird's-foot trefoil, meadow vetchling and vetches.

10.7.131 Shrill carder bee nests are usually built on the ground, or just below the surface, in thick vegetation such as tall or tussocky grassland. Suitable nesting areas would be provided.

10.7.132 The additional mitigation which would be provided by the SSSI Mitigation Strategy (Appendix 10.35) would also include measures to improve the species diversity of existing grasslands, to create new species-rich grassland on areas which are currently arable land, to enhance the biodiversity of existing reen and ditch banks, and to create new ditches, with associated bank vegetation, all of which would be of benefit to shrill carder bee.

10.7.133 Additional mitigation as part of construction would comprise restoring the construction sites at Great Pencarn, within Newport Docks and at Tata Steel, so far as practicable, to provide a mosaic of habitats including areas with food plant species of value to shrill carder bee.

Assessment of Potential Effects

10.7.134 The magnitude of the impacts on shrill carder bee (National (High) value) taking into account the mitigation measures included in the Scheme and shown on the EMP (Figure 2.6), particularly the extent of species-rich grassland, and allowing for the extensive reen and ditch-side habitat suitable for the species across the Levels, is assessed as Moderate Adverse and the significance of effects as Moderate or Large at all timescales.

Assessment of Effects with Additional Mitigation

10.7.135 The magnitude of the impacts on shrill carder bee (National (High) value) taking into account the additional mitigation comprising the habitat improvements included in the SSSI Mitigation Strategy (Appendix 10.35) and the sympathetic restoration of the construction sites at Great Pencarn, Newport Docks and Tata Steel would be Moderate Adverse and the significance of effects would be Moderate or Large. In the medium and long term, as the new and replacement habitats develop, the magnitude of impacts would be Minor Adverse and the significance of effects would be Slight or Moderate.

Wet Grassland Plants

10.7.136 As explained under Coastal and Floodplain Grazing Marsh above, the land take for the new section of motorway would result in the loss of 86.4 ha of grassland habitat within the Levels (of which 77.6 ha would be permanently lost and 8.85 ha would be within the temporary construction areas). This would include areas identified as supporting notable plant species such as those listed below.

- Whitecross Farm (chainage 7750 to chainage 8000) – Tubular water dropwort, Smooth brome, Meadow barley.
- New Dairy Farm (chainage 8000 to chainage 8400) – Tubular water dropwort.
- Solutia (chainage 11800 to chainage 12350) – Common cudweed, Wall bedstraw, Fine-leaved water dropwort, Smooth brome, Brown sedge, Meadow barley, Grass vetchling, Meadow vetchling, Pepper saxifrage, Keel-fruited corn salad.
- Broad Street Common (chainage 12700 to chainage 13000) – Corky-fruited water dropwort, Smooth brome, Meadow barley, Grass vetchling, Spotted medick, Stone parsley.
- Tatton Farm (chainage 13000 to chainage 13900) – Tubular water dropwort, Smooth brome, Meadow barley, Stone parsley.
- Green Moor brownfield land (chainage 16600 to chainage 16900) – Tubular water dropwort, Brown sedge, Meadow barley, Meadow vetchling, Narrow-leaved bird's-foot trefoil, Pepper saxifrage.
- Green Moor fields (chainage 17200 to chainage 17900) – Tubular water dropwort, Smooth brome, Meadow barley.
- Greenmoor Lane (chainage 19600 to chainage 19800) – Common meadow-rue, Brown sedge.

10.7.137 As part of the Scheme, the EMP (Figure 2.6) includes areas to be managed as marsh/wet grassland along the route from approximately chainage 12700 - chainage 13000 and chainage 17900 - chainage 19150. The total area of this habitat included in the EMP is some 18.3ha, some of which is already similar habitat.

10.7.138 As explained above under Coastal and Floodplain Grazing Marsh, the strategy to mitigate the effects of loss of grazing marsh is described in the SSSI Mitigation Strategy (Appendix 10.35). The strategy explains that three potential mitigation areas have been identified at Maerdy Farm to the west of the River Ebbw and Tatton Farm and Caldicot Moor to the east of the River Usk. The actual land requirements are to be agreed with NRW. The strategy sets out the measures which would be implemented within these areas. The measures to improve and create grassland habitat in these areas would benefit the assemblage of notable plant species characteristic of wet grassland.

Assessment of Potential Effects

10.7.139 The magnitude of the impacts on notable wet grassland plants (County (Medium) value) taking into account the mitigation measures included in the Scheme and shown on the EMP (Figure 2.6) including marsh/wet grassland, and acknowledging the extensive areas of wet grassland across the Levels, is

assessed as Moderate Adverse and the significance of effects as Moderate at all timescales.

Assessment of Effects with Additional Mitigation

10.7.140 Taking into account the extensive creation of suitable habitat which would result from implementation of the SSSI Mitigation Strategy (Appendix 10.35), the magnitude of impact would be Moderate Adverse and of Moderate significance in the short term. In the medium and long term, as the habitat improvements take effect, the magnitude of impacts is assessed as Minor Adverse and the significance of effects would be Slight.

Farmland

Introduction

10.7.141 The Farmland Ecological Unit includes the following VERS.

- Lowland mixed deciduous woodland (including wet woodland).
- Hedgerows.
- Lowland meadow.
- Dormouse.
- Badger.
- Hedgehog.

10.7.142 The overall impacts of the land take for the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme and then the additional mitigation proposed. Then the impacts on each of the relevant VERs is assessed.

10.7.143 As explained in Section 10.4, areas of woodland are relatively infrequent in the area of the new section of motorway, typically comprising small, discrete units of broadleaved semi-natural woodland and broadleaved plantation woodland within a farmed landscape.

10.7.144 The woodlands which would be affected by the new section of motorway can be broadly grouped as plantation woodland (of which the largest areas are those associated with the motorway junction at Castleton) and semi-natural broadleaved woodland (of which there are small areas along the route, with the only large woodlands being those to the north of Undy Magor and Rogiet in the east of the area in the vicinity of the proposed haul road to Ifton Quarry).

10.7.145 The total loss of woodland habitat as a result of the land take for the new section of motorway (including that within temporary construction areas) would be 49.8 ha (of which 7.15 ha is semi-natural woodland and 42.65 ha plantation).

10.7.146 As explained in Section 10.4, hedgerows typically border the fields along the route of the new section of motorway (within the Gwent Levels section often adjacent to the reen or ditch forming the field boundary). Important hedgerows (in terms of the Hedgerow Regulations 1995) were recorded in a number of areas along the route of the new section of motorway at Castleton, Berryhill Farm, south of Duffryn, east and south of Solutia, Pye Corner, Whitson substation, Bareland Street, Knollbury, north of Undy, and Llanfihangel near Rogiet.

10.7.147 The new section of motorway would result in the loss of a total of some 35.8 km of hedgerows of which some 8.2 km are species-rich intact hedgerows. The remaining 27.6 km are species-poor and/or defunct hedgerows.

10.7.148 As explained in Section 10.4, most of the grassland within the corridor of the new section of motorway is improved or semi-improved grassland of little intrinsic ecological value. Where grasslands of more potential interest were identified through the Phase 1 Habitat Surveys, these were subject to more detailed NVC/botanical survey. The reports of these more detailed surveys are at Appendices 10.4 and 10.20 respectively.

Lowland Mixed Deciduous Woodland (including Wet Woodland)

10.7.149 The larger areas of plantation woodland which would be affected by the new section of motorway are located in the Castleton area and comprise linear plantings within the existing M4 boundary having been planted as part of the original M4, and also subsequent widening schemes. Taking the section of the new section of motorway between the Castleton Interchange and the River Usk, 23.8 ha of plantation woodland would be lost. This is mainly alongside the existing motorway and road network. The woodlands are predominantly broadleaved with species including hazel, hawthorn, ash with some Scots pine. In the same section of the route 2.60 ha of semi-natural woodland wood be lost. This includes 1.04 ha of ancient woodland (a mature oak and ash woodland including old coppice stools) at Berryhill Farm. There would also be small losses of the edge of a small ancient woodland at Pwll Diwaelod. The remainder of the semi-natural woodland which would be lost include small areas of scrub woodland.

10.7.150 In the section of the route east of the River Usk some 18.8 ha of plantation woodland and 4.55 ha of semi-natural woodland would be lost. The plantation is again largely associated with the existing M4 at Magor Services, along the M4 to the east and around the M4/M48 Junction. The semi-natural woodland is largely developing scrub/woodland including areas which have developed on former industrial land to the east of Newport Docks, at Pye Corner, within the Tata Steel land, and small blocks of woodland north and south of the existing M4 north of Magor.

10.7.151 The haul road to Ifton Quarry would pass through the southern end of the ancient semi-natural woodland at Roggiett Brake. However the haul road would use an existing track through the wood which was used as a haul road when stone was transported from the quarry for construction of the Second Severn Crossing. Some clearance of scrub which has colonised the former track at the south of Roggiett Brake would be required, as would trimming of vegetation on either side of the haul road, but there would be no significant loss of woodland.

10.7.152 As shown on the EMP (Figure 2.6), the new section of motorway includes extensive planting of woodlands, the main areas being around the Castleton Interchange in the west and to the north and east of Magor in the east. These woodlands would serve to both mitigate for the loss of the ecological vale of the existing woodlands and to assimilate the junctions into the landscape (as described in Chapter 9 Landscape).

10.7.153 The new planting shown on the EMP comprises 103 ha of ‘Woodland’ and ‘Linear Belts of Trees and Shrubs’ similar to those associated with the existing M4.

Unlike the existing woodland, there would be extensive new woodland blocks at Berryhill Farm in the west, and east of Rockfield Farm at Undy in the east. The overall ratio of new planting to that which would be lost would be 2.1:1.

10.7.154 The total area of new planting west of the River Usk would be 58.6 ha. Thus the ratio of the area of new planting to that which would be lost in this section of the route would be 2.2:1. East of the River Usk there would be 44.3 ha of new planting, so here the ratio of new planting to that which would be lost would be 1.9:1.

10.7.155 The species composition of the new planting is described in Chapter 9 Landscape and would comprise a mixture of native tree and shrub species. Planting stock would be selected following the guidance of the Forestry Commission Practice Note Using Local Stock for Planting Native Trees and Shrubs (Herbert *et al.*, 1999).

10.7.156 At Berryhill Farm, during clearance of the existing wood, to the extent practicable, coppice stools of hazel and other shrub species would be lifted and replanted in areas of woodland planting to the east of New Park Farm north of the new Castleton Interchange in an area which would not otherwise be disturbed. Woodland topsoil from this wood would also be stripped and placed in new planting areas to encourage the establishment of the woodland ground flora.

Assessment of Potential Effects

10.7.157 The assessment takes into account the planting included in the Scheme which is shown on the EMP (Figure 2.6) and described in Chapter 9 Landscape, recognising that the overall ratio of new woodland to that which would be lost would 2.1:1. Differentiating between plantation (District (Low) value) and semi-natural woodland (County (Medium) value) the assessments are as follows.

- Plantation woodland: Moderate Adverse impacts and effects of Slight significance in the short and medium term, but in the long term as the new plantings mature Negligible Adverse impacts and effects of Neutral or Slight Significance, and potentially Moderate Beneficial impacts.
- Semi-natural woodland: Major Adverse impact and effect of Moderate or Large significance at all timescales.

Assessment of Effects with Additional Mitigation

10.7.158 The magnitude of the impact on lowland mixed deciduous woodland as a result of land take, taking into the additional mitigation comprising re-use of coppice stools and woodland soils, and differentiating between plantation (District (Low) value) and semi-natural woodland (County (Medium) value) would remain as set out below.

- Plantation woodland: Moderate Adverse impacts and effects of Slight significance in the short and medium term, but in the long term Negligible Adverse impacts and effects of Neutral or Slight significance and potentially Moderate Beneficial impacts.
- Semi-natural woodland: Major Adverse impact and effects of Moderate or Large significance in the short and medium terms, but in the long term Moderate Adverse impacts and effects of Moderate significance.

Hedgerows

10.7.159 As explained in Section 10.4, hedgerows typically border the fields along the route of the new section of motorway (within the Gwent Levels section often adjacent to the reen or ditch forming the field boundary). Important hedgerows (in terms of the Hedgerow Regulations 1995) were recorded in a number of areas along the route of the new section of motorway at Castleton, Berryhill Farm, south of Duffryn, east and south of Solutia, Pye Corner, Whitson substation, Bareland Street, Knollbury, north of Undy, and Llanfihangel near Rogiet.

10.7.160 The new section of motorway would result in the loss of a total of some 35.8 km of hedgerows of which some 8.2 km are species-rich intact hedgerows. The remaining 27.6 km are species-poor and/or defunct hedgerows.

10.7.161 Much of the route of the new section of motorway would be through the Gwent Levels. Whilst the hedgerows within the Levels, typically along the reens and ditches which form the field boundaries, are of biodiversity value, NRW also consider them to be detrimental to the ecology of the reens and ditches which support the important aquatic plant and animal communities which are key features of the Gwent Levels SSSIs as they cause shading and interfere with management of the watercourses. NRW have thus indicated that hedgerow planting would not be appropriate within the Gwent Levels SSSIs. This is because hedgerows along the field boundaries can result in overgrowth/shading of the reens and field ditches with adverse effects on aquatic macrophytes and invertebrates which are the important features of the SSSIs.

10.7.162 At either end of the new section of motorway, the extensive woodland and other landscape planting proposed at the Castleton and Magor Interchanges means that there would be little opportunity for hedgerow planting in these areas. Nevertheless, as shown on the EMP (Figure 2.6) the landscape proposals include some 3.6 km of new hedgerows. These include new hedgerows either side of Lighthouse Road (chainage 7100 to chainage 7650), at WTA6 (chainage 12130 to chainage 12350, at Pye Corner (chainage 12350 to chainage 12550), short section of hedge on field boundaries south of the Euro Park Industrial Estate (chainage 17900 to chainage 18500), North of Bencroft Lane and the M48 junction (chainage 23300 to the end of the route), and to the west of Llanfihagel near Rogiet around the new junction. As explained in Chapter 9 Landscape, the new hedgerows would be established with species and of Welsh provenance so far as practicable.

Assessment of Potential Effects

10.7.163 Taking into account the extent of the new hedgerow planting included in the Scheme (Figure 2.6), the magnitude of the loss of hedgerows (County (Medium) value) as a result of the land take for the new section of motorway is assessed as Moderate and the significance of effect as Moderate at all timescales.

Assessment of Effects with Additional Mitigation

10.7.164 No additional mitigation is proposed, thus the magnitude of the loss of hedgerows (County (Medium) value) as a result of the land take for the new section of motorway would remain as Moderate and the significance of effect as Moderate. However, it must be appreciated that the woodland and linear planting at Castleton and Magor at either end of the route would provide habitats of greater

biodiversity value and would provide wildlife corridors, and NRW do not favour hedgerow planting within the Gwent Levels SSSIs.

Lowland Meadow

10.7.165 Of the sites which were subject to detailed survey, the new section of motorway would result in the loss of all of the NVC MG5 grassland at Pound Hill. This is a small site of some 1.36 ha. This was also one of the sites included in the waxcap survey (report at Appendix 10.33) and seven species were found.

10.7.166 Similarly the ungrazed road verge habitat adjacent to the existing M4 at Pound Hill and adjacent to Pwll Diwaelod which supports moderately diverse NVC MG1 grassland would be lost. There would only be a minor loss of the cattle-grazed NVC MG6 grassland within the site at Pwll Diwaelod. This was the other site which was surveyed for waxcap fungi and eight species were found (report at Appendix 10.33).

10.7.167 There would be no loss of MG5 grassland adjacent to Rectory Woods at Rogiet.

10.7.168 The majority of the lowland grassland habitat recorded is of no more than District (Low) value. The grasslands at Pound Hill and Pwll Diwaelod are of County (Medium) value on account of their grassland vegetation and waxcap fungi.

10.7.169 Overall, based on the Phase 1 Habitat Survey mapping (Figure 10.4), the Scheme would result in the loss of some 7.01 ha of unimproved grassland.

10.7.170 The landscape proposals described in Chapter 9 Landscape and shown on the EMP (Figure 2.6) includes some 26.1 ha of species-rich grassland. This is primarily on south facing road embankments and on the banks enclosing the water treatment areas.

10.7.171 The total loss of all grasslands as a result of the new section of motorway would amount to some 250 ha. As explained earlier in this section, some 86 ha of this land is grassland within the Gwent Levels SSSIs and has been classed as grazing marsh. The remaining total grassland loss outside the SSSIs would be some 164 ha the majority of which is improved or semi-improved grassland of little intrinsic ecological interest.

10.7.172 The total area of all grassland (excluding amenity grassland) included in the EMP (Figure 2.6) is some 117 ha. As explained earlier in the section relating to coastal grazing marsh, the SSSI mitigation proposals would also result in the creation of additional grassland and improvement in the biodiversity value of existing grassland.

Assessment of Potential Effects

10.7.173 The assessment takes into account the limited areas of species-rich grasslands that would be affected, and that the landscape proposals (Figure 2.6) provide for establishment of some 117 ha of grassland, of which 26.1 ha would be species-rich. Valuing the grasslands outside the SSSI as of no more than District (Low) value, other than the species-rich grasslands which are valued at the County (Medium) level, impacts are assessed as follows.

- Species-rich grasslands: Moderate Adverse magnitude of impacts leading to effects of Moderate significance in the short term. This would reduce to a

magnitude of impact of Minor Adverse and effect of Slight significance in the medium and long term as the new grassland develops.

- Other non-SSSI grasslands: Moderate Adverse magnitude of impacts leading to effects of Slight significance in the short term becoming Minor Adverse and effects of Neutral or Slight significance in the medium and long term.

Assessment of Effects with Additional Mitigation

10.7.174 Consideration would be given to the practicality of translocating the waxcap turf from the grassland at Pound Hill, or otherwise establishing the fungi elsewhere. Since the effectiveness of such methods has yet to be demonstrated, no change in the assessment of the significance of the impact has been made on this account. The SSSI Mitigation Strategy (Appendix 10.35) would also result in the creation of additional grassland and improvement in the biodiversity value of existing grassland. The magnitude of impacts taking into account this additional mitigation would however remain as follows.

- Species-rich grasslands: Moderate Adverse magnitude of impacts leading to effects of Moderate significance in the short term. This would reduce to a Minor Adverse magnitude of impact and an effect of Slight significance in the medium and long term as the new grassland develops.
- Other non-SSSI grasslands: Moderate Adverse magnitude of impacts leading to effects of Slight significance in the short term. This would reduce to a Minor Adverse magnitude of impact and an effect of Neutral or Slight significance in the medium and long term.

Dormouse

10.7.175 The results of the 2014 and 2015 hazel dormouse surveys (Appendices 10.9 and 10.26 respectively and Figure 10.8) confirm the main area for dormouse is around the Castleton Interchange at the west of the route with a smaller population north of Magor at the east. There were findings of two dormouse nests within the Gwent Levels in the Tata Steel area. 18.16 ha of woodland would be lost to the Scheme in the Castleton section and 17.84 ha in the Magor section.

10.7.176 In the long term, replacement woodland planting would result in an increase in habitat of potential value to dormice throughout the new section of motorway footprint (103 ha of woodland and linear belt planting as shown on the EMP (Figure 2.6) to replace 49.7 ha of woodland loss). However, hazel dormice would require replacement habitat with immediate effect. Therefore, the mitigation for the Scheme would include dormouse trapping and translocation to a favourable off-site location. This trapping and translocation would be undertaken in accordance with a European Protected Species licence and associated method statement. Investigations of potential receptor sites are progressing in consultation with NRW. The receptor site, which would be agreed with NRW, would contain adequate favourable habitat prior to the commencement of trapping and translocation to support the translocated population and would offer opportunities for any future expansion of the population.

10.7.177 In the long term, should it be necessary or considered appropriate, and with prior agreement and licencing from NRW, dormice could be returned to the area by translocating them to areas of established and sufficiently developed replacement

woodland and scrub with good habitat connectivity to other parcels of woodland and/or scrub and mature wide hedgerows, with hazel plants of at least seven years of age so as to help ensure a nut harvest for dormice to feed on during autumn/early winter.

10.7.178 Should no favourable off-site receptor site be located prior to the commencement of construction, with NRW approval and licencing, dormice would be trapped and translocated prior to construction to a temporary holding site in order to be cared for in captivity until an off-site receptor site has been enhanced to favourable condition or replacement planting associated with the Scheme has established and developed sufficiently to support the dormouse population in the long term, as described above. In principle agreement has been reached with Bristol Zoo regarding accommodation of a captive population of dormouse until such time as they can be released if such a facility is required.

Assessment of Potential Effects

10.7.179 Taking into account the amount of habitat of known and potential value to hazel dormice that would be lost to construction of the new section of motorway and the extent of replacement habitat included in the EMP (Figure 2.6), the magnitude of the impact of habitat loss on the local hazel dormouse population (a receptor of County (Medium) value) is assessed as Major Adverse and the effects of Moderate or Large significance in the short and medium term. In the long term as the new planting matured, the magnitude of impacts is assessed as Moderate adverse and the significance of effects as Moderate.

Assessment of Effects with Additional Mitigation

10.7.180 Taking into account the translocation of dormouse to a favourable receptor site, or temporary holding location before dormice can be relocated to a favourable off-site receptor site or returned to replacement planting areas, the magnitude of the impact of habitat loss with mitigation is assessed as Minor Adverse leading to effects of Slight significance in the short and medium term.

10.7.181 In the long term, replacement planting would further reduce the magnitude of the impact on dormice that could be returned to the area, or dormice located in the immediately surrounding area, due to substantial increase in the amount of woodland and the potential to manage the areas for the benefit of dormice, and in the long term would be likely to be Beneficial.

Badger

10.7.182 Results of the 2014 and 2015 badger surveys (Confidential Appendices 10.37 and 10.38) confirm the presence of the following badger setts within or immediately adjacent to working areas. Due to their location, it is likely that the setts would be removed for construction.

- Main sett E (active).
- Main sett H (active in 2014; inactive late 2015).
- Main sett I (active).
- Outlier sett V (active).
- Outlier sett Q (active).

- Outlier sett J (active).
- Outlier sett M (disused).
- Outlier sett Y (disused).
- Outlier sett Z (disused).

10.7.183 The mitigation would include the installation of mammal exclusion fencing along the construction and operational parts of the new section of motorway (as described in Chapter 3: Scheme Construction). Fencelines would be altered along the route so as to guide badgers towards culverts with adjacent 900 mm mammal tunnels and other mammal crossings, thereby helping to ensure their effectiveness.

10.7.184 Badgers will use a variety of habitats within their home range for foraging, including woodland, hedgerows, grassland including rough grass margins along the banks of watercourses and arable land.

10.7.185 As shown on the EMP (Figure 2.6) the Scheme would result in extensive woodland planting which would be available to badgers outside the highway boundary. The additional mitigation set out in the SSSI Mitigation Strategy (Appendix 10.35), which would result in conversion of arable land to grassland, and improvement in the biodiversity of existing grasslands would also be of benefit to badger.

10.7.186 As part of the additional mitigation for the Scheme, three artificial setts would be constructed in order to provide alternative habitat for use by any badgers displaced from the three active main setts E, H and I.

10.7.187 Since outlier setts are less frequently used or may be temporary setts, replacement setts for these would not be necessary.

10.7.188 Artificial setts would be constructed prior to closing main setts and all closures of active setts would be carried out in accordance with the requirements of an NRW licence for badgers which would be obtained prior to the commencement of licenced works.

10.7.189 Pre-construction surveys for badger setts and signs of badger activity would be undertaken in order to locate any new setts and inform the final mitigation strategy and NRW licence application. An artificial sett would be constructed for each additional main sett that might require closing under an NRW licence.

10.7.190 The additional mitigation for the Scheme would also include the construction of dry mammal crossings and culverts with adjacent 900 mm mammal tunnels, constructed in accordance with guidelines published in DMRB Volume 10, Section 4, Parts 2 (2001) and 4 (1999) as described in Chapter 2: Scheme Description and shown on the EMP (Figure 2.6). The locations of these crossing points would help to ensure badgers could continue to access retained habitats across their home ranges, thereby minimising the impact of habitat loss.

10.7.191 The construction of culverts and installation of mammal fencing would be undertaken during the first eight months of the works on the Caldicot Levels and the first nine months on the Wentlooge Levels (Appendix 3.1 Buildability Report). Mammal crossings would be constructed as soon as practicable during construction of the road formation.

Assessment of Potential Effects

10.7.192 Taking into account the amount of planting and habitat creation proposed as part of the Scheme which would be of potential value to badgers (shown on the EMP Figure 2.6), and the installation of permanent mammal fencing, the magnitude of the impact of habitat loss on the local badger population (a receptor of District (Low) value) is assessed to be Major Adverse leading to effects of Slight or Moderate significance in the short to medium term primarily due to the number and type of active setts that would be lost during construction. In the longer term the magnitude of impacts would be Moderate adverse and the significance of effects Slight as the new habitats mature and the badger population readjusts.

Assessment of Effects with Additional Mitigation

10.7.193 Taking into account the provision of three replacement badger setts, the provision of mammal crossings, the provision of adjacent dry tunnels of 900 mm diameter at all new culverts, and the detailed design of wildlife fencing to guide badgers towards culverts and mammal crossings the magnitude of the impact of habitat loss with mitigation on badgers is assessed to be Minor Adverse and the effects of Neutral or Slight significance in the short and medium term. In the longer term the magnitude is assessed as Negligible and the significance of effects as Neutral or Slight.

Hedgehog

10.7.194 Hedgehogs utilise a variety of habitats, including woodland and scrub, hedgerows and rough grass field margins.

10.7.195 The new section of motorway would result in the loss of woodland (49.7 ha), scrub (28 ha), hedgerows (35.8 km) and grass margins along field boundaries of potential value to hedgehogs. However, replacement planting to be undertaken as part of the Scheme (as shown on the EMP at Figure 2.6), primarily woodland (103 ha) and scrub (7.06 ha) and grassland creation (117 ha), would be of benefit in the medium to long term.

10.7.196 Hedgehogs' home ranges vary in size, depending on the resources available from an average of 32 ha for male hedgehogs and 10 ha for female hedgehogs and hedgehogs can show strong home range fidelity (Morris and Reeve (cited in Wildlife on Line, 2014)). As part of the additional mitigation for the Scheme, dry mammal crossings and box culverts with adjacent dry mammal tunnels of 900 mm diameter (as described in Chapter 2: Scheme Description and shown on the EMP at Figure 2.6), would provide crossing points which hedgehogs could use in order to access retained parts of their home range either side of the new road, as well as to access new and replacement habitats. These crossing points would help to reduce the potential impact of habitat loss.

10.7.197 Mammal exclusion fencing installed as part of the Scheme as shown on the EMP (Figure 2.6) would also help to guide hedgehogs into culverts with adjacent dry mammal tunnels and other mammal crossings, thereby helping to ensure their effectiveness.

10.7.198 The construction of culverts and installation of mammal fencing would be undertaken during the first eight months of the works on the Caldicot Levels and the first nine months on the Wentlooge Levels (Appendix 3.1 Buildability Report).

Mammal crossings would be constructed as soon as practicable during construction of the road formation.

10.7.199 In addition, management of SSSI Mitigation Areas, as described in the SSSI Mitigation Strategy (Appendix 10.35), could also provide a benefit to hedgehogs. Management may include arable reversion to grassland, low input management of grassland, measures to encourage the development of wider hedgerows with improved ground cover, and the restoration of historic field boundaries with associated rough grass margins.

Assessment of Potential Effects

10.7.200 Taking into account the amount of replacement planting, habitat creation and mammal fencing (shown on the EMP at Figure 2.6), the magnitude of the impact of habitat loss on the local hedgehog population (a receptor of District (Low) value) is assessed as Moderate Adverse and the significance of effects as Slight in the short and medium term. In the longer term as the new habitats mature the magnitude of impacts is assessed as Minor Adverse and the significance of effects as Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.7.201 Taking into account the installation of mammal crossings, dry mammal tunnels of 900 mm diameter at culverts, and the detailed design of fencing to guide wildlife to the culverts and mammal crossings, the magnitude of the impact of habitat loss on the local hedgehog population with mitigation is assessed as Minor Adverse and the significance of effects as Neutral or Slight in the short and medium term. In the longer term the level of impact would be further reduced as result of the amount of new habitat of value to the species that would be available and could be Beneficial.

Industrial Land

10.7.202 The Industrial Land Ecological Unit includes the following VERS.

- Open mosaic habitats on previously developed land.
- Reptiles (Common lizard, slow worm).
- Terrestrial invertebrates.

10.7.203 The overall impacts of the land take for the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme and then the additional mitigation proposed. Then the impacts on each of the relevant VERs is assessed.

10.7.204 As explained in Section 10.4 there are areas of ‘brownfield’ land at Great Pencarn, south of the Solutia works, in Newport Docks, south of the Tata Steelworks at Llanwern and at Green Moor. Vegetation regenerating on the brownfield land typically comprises a mosaic of grassland and scrub often formed on man-modified substrata, such as concrete rubble at Solutia and steelworks slag at Tata Steel and Green Moor, and includes a number of locally notable species.

10.7.205 The effects of the new section of motorway on grass snake are considered separately in this chapter under Reens and Ditches. The other two reptiles found in the surveys undertaken for the Scheme were common lizard and slow worm.

10.7.206 As explained in Section 10.4, single common lizards were recorded at the eastern edge of Magor Services and the former laboratory site at Pye Corner in 2014 indicating low populations in these areas.

10.7.207 In 2015 common lizard and slow worm (and grass snake) were recorded within Newport Docks. The peak counts of single common lizard and slow worm indicate low populations. As explained in Section 10.5 prior to commencement of construction in areas where common lizard and slow worm populations have been identified, reptile fencing would be installed and reptiles would be captured and transferred to suitable habitat on the margin of the Scheme, or to suitable habitat within the SSSI mitigation areas (Appendix 10.35) or elsewhere by agreement. The detailed method statement for the capture and translocation would be agreed with NRW in advance.

10.7.208 Both the 2014 and 2015 terrestrial invertebrate surveys identified species of nature conservation importance. The 2014 survey was largely undertaken on the margins of reens and ditches within the Gwent Levels. The 2015 survey was carried out on areas of brownfield land within Newport Docks and Tata Steel, together with a wider ranging survey for bumblebees, focussing on shrill carder bee and brown-banded carder bee across the Gwent Levels section of the route.

10.7.209 The effects of the new section of motorway on shrill carder bee and Brown-banded carder bee are considered under the Grazing Marsh habitat in this chapter.

10.7.210 In so far as there would be effects on the invertebrate assemblages associated with the reens and ditches, these would be a function of the effects on this habitat set out earlier in this section and would be effectively mitigated by the Reen Mitigation Strategy (Appendix 2.3). In so far as the SSSI Mitigation Strategy (Appendix 10.35) would also provide additional and enhanced reen and ditch margins, this would also be of benefit to this invertebrate assemblage.

10.7.211 This section is concerned with the assemblages of terrestrial invertebrates recorded at Tata Steel and Newport Docks, and so associated with brownfield sites.

10.7.212 As explained in Section 10.4, the survey within Newport Docks identified 329 species. Of these 32 (9.7%) were considered to be 'Key Species', seven of them of Red Data Book or equivalent status. This represents a good diversity for such an open site. One species, a fly *Liriomyza intonsa,* is new for Britain. The survey showed that the saltmarsh beside the River Ebbw is of particular conservation importance.

10.7.213 The survey within Tata Steel's land recorded 378 species. Of these 31 (8.2%) were considered to be 'Key Species', nine of them of Red Data Book or equivalent status (2.4%). This is a good diversity for the habitat types present. The proportion of Key Species was good, indicating an area of significant invertebrate conservation value. Of particular interest were a fly *Hydrophorus viridis* and a hoverfly *Sphaerophoria loewi*, both very rare nationally. Reens and ephemeral pools were particularly important for the rarest species found.

Reedbeds and sedge beds were also important for a number of scarce species and general biodiversity. Old poplar trees were also of interest.

10.7.214 The brownfield site at Great Pencarn would be almost entirely taken up by the main construction compound for the new section of motorway.

10.7.215 In the section of Newport Docks between the River Ebbw and the River Usk, much of the vegetated brownfield land would be taken up by the embankment for the new motorway from the River Ebbw eastwards to the start of the viaduct section, by the link to Docks Way and its junction with the new section of motorway, or by temporary construction areas south of the embankment and east of the Docks Way link.

10.7.216 East of the River Usk there would be losses of areas of vegetated brownfield land adjacent to the saltmarsh on the east bank of the river, either side of the Uskmouth railway line, south of the Solutia works, and an area between the Uskmouth railway line and the River Usk in order to provide construction areas for the viaduct and Usk crossing.

10.7.217 The new section of motorway along the south of the Tata Steel land and across Green Moor, and the associated construction areas, would pass through brownfield land including sludge lagoons and their embankments.

10.7.218 As explained in Chapter 3: Scheme Construction, following completion of the works all temporary construction work sites would be removed and the land affected would be restored. In restoring the construction sites at Great Pencarn, within Newport Docks and Tata Steel, so far as practicable a mosaic of habitat types providing some of the characteristics of brownfield land would be provided. Such habitats include areas of unvegetated, loose bare substrate and pools and early successional communities consisting mainly of stress-tolerant species (e.g. indicative of low nutrient status or drought) which may be composed of annuals, mosses and liverworts, lichens, ruderals, inundation species, and open and flower-rich grassland. Hibernacula for reptiles, potentially using suitable surplus materials derived from construction would be provided.

Open Mosaic Habitats on Previously Developed Land

Assessment of Potential Effects

10.7.219 On the basis of the extent of loss of this habitat described above, principally at Great Pencarn, Newport Docks and Tata Steel, the magnitude of the impacts on the Open mosaic habitats on previously developed land habitat (County (Medium) value) is assessed as Major Adverse and the significance of effects as Moderate or Large at all timescales.

Assessment of Effects with Additional Mitigation

10.7.220 The magnitude of the impacts on the Open mosaic habitats on previously developed land habitat (County (Medium) value) taking into account the sympathetic restoration of the land at Great Pencarn, Newport Docks and Tata Steel is assessed as Major Adverse and the significance of effects as Moderate or Large in the medium term. The magnitude of effects would be Moderate Adverse leading to effects of Moderate significance in the long term.

Reptiles (Common Lizard, Slow Worm)

10.7.221 As explained above, in the section of Newport Docks between the River Ebbw and the River Usk, much of the vegetated brownfield land would be taken up by the embankment for the new section of motorway from the River Ebbw eastwards to the start of the viaduct section, by the link to Docks Way and its junction with the new motorway, or by temporary construction areas south of the embankment and east of the Docks Way link. Thus much of the habitat suitable for reptiles in this area would be removed.

10.7.222 At Pye Corner, the new section of motorway would cross the north western corner of the old laboratory site, and the diverted Nash Road and southern embankment for the new overbridge would occupy the western edge. Otherwise the habitat suitable for common lizard here would be unaffected.

10.7.223 At Magor Services, the area where common lizard was recorded would not be affected by the new section of motorway.

10.7.224 Both Common lizard and Slow worm are partially protected under the Wildlife and Countryside Act 1981 (as amended) against intentional or reckless killing and injuring and trade and a pre-construction capture and translocation would be carried out as described in Section 10.5 above.

10.7.225 As explained in Chapter 3: Scheme Construction, following completion of the works all temporary construction work sites would be removed and the land affected would be restored. In restoring the construction sites at Great Pencarn, Newport Docks and Tata Steel, so far as practicable a mosaic of habitat types providing some of the characteristics of brownfield land suitable for reptiles would be provided.

Assessment of Potential Effects

The magnitude of the impact of the land take for the new section of motorway on Common lizard and Slow worm (of District (Low) value) would be Major Adverse and the significance of effect Slight or Moderate at all timescales.

Assessment of Effects with Additional Mitigation

10.7.226 The magnitude of the impact taking into account the sympathetic restoration of the construction land at Newport Docks would be Moderate Adverse and the significance of effect Slight in the medium term. In the long term, as the habitats recovered, the magnitude of the impact would be Minor Adverse and the significance of effect Neutral or Slight.

Terrestrial Invertebrates

10.7.227 As explained earlier in this section, the footprint of the new section of motorway, together with the land required for temporary construction uses would result in the loss of brownfield land at Great Pencarn – Duffryn, the section of Newport Docks between the River Ebbw and the River Usk, east of the River Usk adjacent to the saltmarsh on the east bank of the river, either side of the Uskmouth railway line, south of the Solutia works, and an area between the Uskmouth railway line and the River Usk, along the south of the Tata Steel land and across Green Moor.

10.7.228 As explained in Chapter 3: Scheme Construction, following completion of the works all temporary construction work sites would be removed and the land affected would be restored. In restoring the construction sites at Duffryn, within Newport Docks and Tata Steel, so far as practicable a mosaic of habitat types providing some of the characteristics of brownfield land would be provided.

Assessment of Potential Effects

10.7.229 The magnitude of the impacts on the terrestrial invertebrate assemblage associated with brownfield land (Regional (Medium) value) would be Major Adverse and the significance of effects Moderate or Large at all timescales.

Assessment of Effects with Additional Mitigation

10.7.230 The magnitude of the impacts on the terrestrial invertebrate assemblage associated with brownfield land (Regional (Medium) value) taking into account the sympathetic restoration of the land at Great Pencarn, Newport Docks and Tata Steel is assessed as Major Adverse and the significance of effects as Moderate or Large in the medium term. In the long term, as the habitats recovered, the magnitude of impacts would be Moderate and the significance of effects Moderate.

Bats

10.7.231 Taking into account the results of the 2014 and 2015 bat surveys (Appendices 10.7 and 10.24), construction of the new section of motorway would require the felling of the following trees and demolition of the following 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 licenceable works.

- Tree 274 (Figure 1a Appendix 10.24), located on Berryhill Farm at the western end of the new section of motorway - a confirmed tree roost for a small number of an unknown species of bat.
- Tree 80 (Figure 1a Appendix 10.24), located on Berryhill Farm at the western end of the Scheme - a confirmed tree roost for a small number of pipistrelle and brown long-eared bats.
- Tree 375 (Figure 1e Appendix 10.24), located near Knollbury at the eastern end of the Scheme - a confirmed tree roost for a small number of an unknown species of bat.
- Tree 39 (Figure 1b Appendix 10.24), located close to Fox Covert to the east of Green Lane in Coedkernew – a possible roost for a small number of an unknown species of bat.
- Tree 45 (Figure 1b Appendix 10.24), located close to Fox Covert to the east of Green Lane in Coedkernew – a possible roost for a small number of an unknown species of bat.
- The Vicarage at Magor, a residential property at the eastern end of the new section of motorway (Figure 1e Appendix 10.24) - a confirmed roost for a small number of common pipistrelles.

- The Old Stores building in Newport Docks, to the west of the River Usk (Figure 1b Appendix 10.24) – a possible roost for a small number of pipistrelle bats.
- Berryhill Farm house and associated buildings (Figure 1a Appendix 10.24) - old record of brown long-eared, common and soprano pipistrelle possible maternity roost (not surveyed in 2014 or 2015).

10.7.232 In addition, Tree 90 (Figure 1d Appendix 10.24), located to the south of the A4810 on the Tata Steel UK Ltd site, which has not yet been surveyed during dusk and/or dawn, is considered to be a possible bat roost due to the presence of features of high potential value to roosting bats. This tree would need to be felled in order to enable construction.

10.7.233 Taking into account the mobile nature of bats, mitigation measures would include pre-construction surveys of mature trees and buildings that would be felled or demolished, or would be at potential risk of significant noise disturbance from the works, in order to confirm the presence/absence of bat roosts. Should any roosts be located and should works require the loss of the roost or be likely to result in the displacement of bats, a European Protected Species licence would be obtained prior to the commencement of works. The pre-construction surveys would inform the licence application and associated method statement.

10.7.234 Bats will use a variety of habitats within their home range for foraging and commuting, including woodland edge, woodland, trees, hedgerows, watercourses and areas of insect-rich rough grassland.

10.7.235 As a result of the new section of motorway, the area of woodland that would be cleared to enable construction would be 49.8 ha. Replacement woodland and linear belt planting would cover an area of 103 ha as shown on the EMP (Figure 2.6). 28 ha of dense scrub would also be lost to construction and would be replaced by 7.06 ha of scrub planting as shown on the EMP (Figure 2.6). As explained in the Reen Mitigation Strategy (Appendix 2.3) the length of reens and associated rough grassland banks that would be lost as a result of realignment and culverting would be 2568 m and the length of ditches with associated grass banks that would be in-filled would be 9143 m. As part of the Scheme, 2657 m of reens and 9771 m of ditches would be constructed to replace the lost watercourses.

10.7.236 The new section of motorway would result in the loss of some 35.8 km of hedgerows. As explained earlier in this section, hedgerow planting within the Gwent Levels SSSIs is not appropriate, and the extensive woodland and other landscape planting proposed at the Castleton and Magor Interchanges means that there would be little opportunity for hedgerow planting in these areas. The landscape proposals shown on the EMP (Figure 2.6) include 3.6 km of hedgerows.

10.7.237 Tree planting within the operational boundary of the new section of motorway would be managed so as to ensure successful establishment.

10.7.238 As shown on the EMP (Figure 2.6) as part of the additional mitigation for the new section of motorway a bat barn would be provided at Water Treatment Area 11c north of Magor to replace the roost at Magor Vicarage which would be removed to construct the new section of motorway. This would be a purpose built building, parts of which would receive full sunlight for the majority of the day, providing

warm conditions for breeding bats. Cool areas would also be included for spring, autumn and winter roosting. Bats that use buildings, and for which such roosts are suitable, can generally be divided into four categories:

- Crevice-dwelling bats (which tend to be hidden from view) include common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Brandt's bat and whiskered bat.
- Roof-void dwelling bats (that may be visible on roof timbers) are serotine, Leisler's bat, Daubenton's bat and barbastelle.
- Bats that need flight space in certain types of roost are Natterer's bat, and brown and grey long-eared bat.
- Bats that need flight space and flying access into the roost are greater horseshoe and lesser horseshoe bat.

10.7.239 Artificial bat roost boxes to replace roosts which would be removed for the new section of motorway would be installed in suitable trees in field boundaries on the edges of the Scheme such as on the margins of construction sites and borrow pits, and elsewhere by agreement. The number and locations of the bat boxes would be agreed with NRW. If a bat roost is found to be present in buildings to be demolished at Berryhill Farm, consideration would be given to provision of a further bat barn within the Scheme in this area.

10.7.240 As part of the additional mitigation for the Scheme, potential crossing points across the new section of motorway would be constructed which would enable bats to gain access to habitat either side of the route, thereby minimising the potential impact of habitat loss. Crossing points would consist of dry mammal crossings and box culverts (as described in Chapter 2: Scheme Description). Underpasses and overbridges constructed as part of the Scheme would also provide potential crossing points for bats.

10.7.241 The locations of culverts and mammal crossings have been selected with the results of bat activity surveys in mind, in particular they would be located as close as practicable to areas of high and very high bat activity, as well as within areas less well-used by bats (Appendix 10.7 and 10.23), in order to maximise the potential for bats to use these crossing points to access surrounding habitats.

10.7.242 In addition, where practicable and in accordance with the landscape objectives for the Gwent Levels, tree and scrub planting along the new road embankment, would be located so as to guide bats towards culverts, mammal crossings, underpasses and overbridges.

10.7.243 The construction of culverts and installation of mammal fencing would be undertaken during the first eight months of the works on the Caldicot Levels and the first nine months on the Wentlooge Levels (Appendix 3.1 Buildability Report). Mammal crossings would be constructed as soon as practicable during construction of the road formation. However, until planting has become established and developed enough to provide an effective habitat corridor for bats, artificial bat corridors (e.g. hazel hurdle fencing) would be used so as to connect surrounding hedgerows and woodland edge to crossing points located close to sites of high and very high value to bats (Appendix 10.7 and 10.23).

Assessment of Potential Effects

10.7.244 Taking into account the number and type of known, probable or possible bat roosts to be lost during construction, the amount of habitat that would be lost and commuting routes that would be severed, that reens would be retained and culverted along the route, and the extent of new planting included in the Scheme as shown on the EMP at Figure 2.6, the magnitude of the impact of habitat loss on the local bat population (a receptor of Regional (Medium) value) is assessed as Major Adverse and the significance of effects as Moderate or Large in the short and medium term. In the long term the magnitude would be Moderate Adverse and the significance of effects Moderate as the new habitats develop.

Assessment of Effects with Additional Mitigation

10.7.245 Taking into account the provision of a bat barn at Magor, the provision of bat boxes, minimising light spill from the highway lighting where provided, provision of mammal crossings which could be used by some bat species, and design of planting to guide bats to culverts the magnitude of the impact of habitat loss with mitigation on bats is assessed as Moderate Adverse and the significance as Moderate in the short and medium term. In the long term the magnitude would be Minor Adverse and the significance Slight.

Breeding Birds

10.7.246 The result of land take for the new section of motorway would be the loss of potentially suitable habitat for a range of bird species recorded utilising the area for breeding in 2014 and 2015.

Assessment of Potential Effects

10.7.247 As explained above there would be no land take within the Severn Estuary SPA/Ramsar site boundary. The named breeding components of the Severn Estuary Ramsar site (lesser black-backed gull (qualifier for future consideration only) and herring gull) are National (High) value species, but they do not use the study area for breeding. Therefore, the predicted magnitude of impact is No change. As a result, the significance of effect on qualifying breeding species of the European designated site is Neutral.

10.7.248 Cetti's warbler (judged to be of National (High) value) is the single breeding species of highest value recorded during the 2014 and 2015 breeding bird surveys. Other breeding birds recorded in the study area are deemed to be of District (Low) value.

10.7.249 No barn owls were confirmed to be nesting during surveys (Appendix 10.29) but the species is known to utilise the study area and results from the 2014 and 2015 surveys suggest that a barn owl nest may be located near Greenmoor Farm. Although the tree which constitutes the nest site would not be directly affected, it is close to the proposed new section of motorway. It is likely to be subject to disturbance during construction and this is considered in Section 10.8. The land take for the new section of motorway would affect land, particularly the edges of reens and ditches, which will provide hunting areas for barn owl.

10.7.250 The mitigation and other measures included in the Scheme which would be of benefit to breeding birds include replacement of reens and ditches (as set out in

the Reen Mitigation Strategy at Appendix 2.3), the extensive woodland planting included in the Scheme (Figure 2.6) and the provision of water treatment areas incorporating ponds and reedbeds.

10.7.251 The predicted magnitude of impact with respect to land take on breeding birds, taking into account the mitigation included in the Scheme would be Moderate Adverse in the short and medium term. The significance of the effect on Cetti's warbler (National (High) value) would therefore be Moderate or Large. For barn owl (County (Medium value) the significance of effect would be Moderate. For the populations of other species recorded in the study area during breeding bird surveys (District (Low) value), the significance of effect would be Slight.

10.7.252 In the long term as habitats develop the magnitude of the impacts would be Minor. The significance of the effect on Cetti's warbler (National (High) value) would be Slight or Moderate. For barn owl the significance of effect would be Slight. For the populations of other species recorded in the study area during breeding bird surveys (District (Low) value), the significance of effect would be Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.7.253 Additional mitigation would be provided as set out in the SSSI Mitigation Strategy at Appendix 10.35 which would comprise the ecological enhancement of land at Maerdy Farm, Tatton Farm and Caldicot Moor.

10.7.254 There is no change with respect to the breeding components of the Severn Estuary Ramsar site. The magnitude remains as No change and the significance as Neutral. The predicted magnitude of impact for Cetti's warbler with respect to land take remains the same in the short term but would be revised to Minor Adverse in the medium term, leading to a significance of effects of Slight or Moderate.

10.7.255 For barn owl the magnitude of the short term impacts would remain as Moderate and the significance Moderate, but in the medium term, as the improvements to the SSSI mitigation areas became effective, the magnitude of land take impacts would be Negligible and the significance of effects Neutral or Slight.

10.7.256 The magnitude of the predicted impacts on other breeding birds would also be reduced to Minor Adverse and the significance of effects Neutral or Slight in the medium and long term.

Wintering Birds

10.7.257 The result of land take by the proposed new section of motorway would be the loss of habitat utilised by a range of species recorded utilising the area during the wintering periods of 2014 and 2015.

10.7.258 There would be no land take within the Severn Estuary SPA/Ramsar site boundary. However, named wintering components of the Severn Estuary SPA/Ramsar site will utilise areas of habitat outside the site boundary if suitable. During the wintering bird surveys, it was determined that for three named species the study area population is of National (High) value (redshank, gadwall and pintail), for three named species the study area population is of County (Medium) value (teal, pochard and shoveler), and for six named species the study area population is of District (Low) value (shelduck, wigeon, tufted duck, curlew,

lapwing and mallard). In addition an array of species that is considered to make up part of the Severn Estuary SPA/Ramsar assemblage were recorded within the study area. This population within the study area is also of District (Low) value.

10.7.259 The value of all remaining species recorded within the study area during the winter is judged to be District (Low).

10.7.260 The most important areas within the study area for wintering birds associated with the Severn Estuary SPA/Ramsar site are the River Ebbw and River Usk.

10.7.261 The land take for this designated site, as well as the River Ebbw crossing, has been minimised during the design process of the crossings and would be 1.43 ha of saltmarsh, of which 1.01 ha would be returned following the completion of construction. 2 ha of replacement saltmarsh would be created south of the proposed River Usk Crossing.

Assessment of Potential Effects

10.7.262 The vast majority of the wintering bird species encountered in the study area were seen outside the projected footprint of the development, and the areas that the river crossings would be built over have no known special significance to any bird species.

10.7.263 The magnitude of impact, due to the small spatial scale on which these land take impacts would occur in areas used by wintering birds associated with the Severn Estuary SPA/Ramsar site is judged to be Negligible Adverse at all timescales. Therefore, with respect to land take, the significance of effect for the wintering birds that are part of the Severn Estuary SPA/Ramsar site would be Slight for species of High value (redshank, gadwall and pintail), Neutral or Slight for species of Medium value (teal, pochard and shoveler), and Neutral or Slight for species of Low value (shelduck, wigeon, tufted duck, curlew, lapwing and mallard), as well as for the other species that make up part of the Severn Estuary SPA/Ramsar assemblage.

10.7.264 For all other wintering species (District (Low) value), the magnitude of impact with respect to land take would be Minor Adverse at all timescales. The significance of effect would therefore be Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.7.265 No additional mitigation is proposed for wintering birds. Thus the magnitude of impact for the birds named in the Severn Estuary SPA/Ramsar site citation, those that are part (named or otherwise) of the SPA assemblage would remain as Negligible Adverse at all timescales. The assessment of significance on these species would therefore also remain as Slight for species of High value (redshank, gadwall and pintail), and Neutral or Slight for species of Medium value (teal, pochard and shoveler) and Low value (shelduck, wigeon, tufted duck, curlew, lapwing and mallard), as well as for the other species that make up part of the Severn Estuary SPA/Ramsar assemblage.

10.7.266 For all other wintering species, the magnitude of impact with respect to land take would remain as Minor Adverse at all timescales. The significance of effect would therefore be Neutral or Slight.

Complementary Measures

10.7.267 As referred to in Section 10.3, the Complementary Measures which are proposed are described in Chapter 2: Scheme Description. These measures would not require any additional land take over and above those discussed in the sections above for the new section of motorway.

10.8 Assessment of Construction Effects

Proposed New Section of Motorway

10.8.1 In this section of this chapter the potential effects of the construction of the new section of motorway on each of the Ecological Units are identified and assessed, first, as required in Wales by DMRB Volume 11, Section 2, Part 5 HA 205/08 (Highways Agency, 2008a), without mitigation, and then with mitigation in place. For the purposes of the assessment, certain measures are considered to be an integral part of the Scheme (embedded mitigation) and are thus included in the initial assessment of potential effects. The extent of the temporary land take for the Scheme for construction purposes is shown on Figure 2.6.

10.8.2 Unless otherwise stated in this section the construction impacts would extend over the timescale of the construction works and so would be medium term effects. Where there are effects of longer duration these are generally related to additional land take for construction compounds and other temporary construction areas.

Designated Sites

European Statutory Designated Sites

10.8.3 The effects of the land take for the new section of motorway on European sites are assessed in Section 10.7. The only site directly affected would be the River Usk SAC where the east pier of the new River Usk Crossing would be constructed in the saltmarsh on the east bank of the River Usk, which is part of the SAC. Although within the SAC, the coastal saltmarsh habitat is not one of the interest features of the designated site.

10.8.4 The total area of 0.69 ha referred to in Section 10.7 includes the land required for the construction compound and access for the east pier. The mitigation proposed for this loss of saltmarsh is for the creation of a new area of saltmarsh in an area to be used for construction of the River Usk Crossing once the works are complete (as shown on the EMP at Figure 2.6).

10.8.5 Of this total area 0.49 ha of this habitat would be temporarily lost (and disturbed) as a result of the construction compounds and access for the River Usk Crossing. Following construction, the area affected by the temporary construction compound would return to saltmarsh.

Assessment of Potential Effects

10.8.6 Taking into account the replacement of saltmarsh which would be affected by the construction of the new River Usk Crossing (as shown on the EMP at Figure 2.6) and which forms part of the Scheme, and recognising that saltmarsh is not one of the features for which the SAC is designated, the magnitude of the construction

impacts on international designated sites (International (Very High) value) is assessed as Negligible Adverse and the significance of effects as Slight at all timescales.

Assessment of Effects with Additional Mitigation

10.8.7 No additional mitigation is proposed and the magnitude of impacts would remain as Negligible Adverse and the significance of effects as Slight.

10.8.8 In so far as there would be construction impacts on individual VERs which are features of the European Sites, these are assessed below and comprise the following.

River Usk SAC

- Migratory fish.
- Otter.

Severn Estuary European Marine Site (SAC, SPA and Ramsar Site)

- Migratory fish (river and sea lamprey, twaite shad, salmon, eel, sea trout and allis shad) and assemblage of fish species.
- Internationally important populations of migratory and wintering bird species and waterfowl.

Wye Valley and Forest of Dean Bat Sites SAC

- Lesser horseshoe and greater horseshoe bats.

National Statutory Designated Sites

10.8.9 The effects of the land take for the new section of motorway on nationally designated sites are assessed in Section 10.7. The new section of motorway would cross the River Usk (Lower Usk) SSSI). The extent of the loss of saltmarsh within the River Usk (Lower Usk) SSSI, together with the measures included in the design of the Scheme and proposed additional mitigation, are as described for the River Usk SAC above. There would be no other habitat loss within the River Usk (Lower Usk) SSSI.

10.8.10 The total permanent land take within the Gwent Levels SSSI would be some 105 ha, of which 35 ha would be to the west of the River Usk and 70 ha would be to the east. An additional 20 ha would be affected during construction; 5.6 ha to the west of the River Usk and 14.4 ha to the east. The construction areas would be restored to grassland habitat following completion of construction.

10.8.11 The Gwent Levels SSSIs are designated primarily for their reens and ditches, and the aquatic flora and fauna which they support, and for the shrill carder bee. The specific impacts of construction on these features are assessed later in this section.

10.8.12 There would be no adverse effects of construction on Magor Marsh SSSI, Rogiet Meadow SSSI or Penhow Woodlands SSSI.

Assessment of Potential Effects

10.8.13 Taking into account the replacement of saltmarsh within the River Usk (Lower Usk) SSSI which would be affected by the construction of the new River Usk Crossing (as shown on the EMP at Figure 2.6), and which forms part of the Scheme, and the small extent of the construction land take within the Gwent Levels SSSIs which would be restored to grassland, the magnitude of the impacts of construction on Nationally Designated Sites (National (High) value) is assessed as Minor Adverse and the significance of effects as Slight or Moderate at all timescales.

Assessment of Effects with Additional Mitigation

10.8.14 Taking into account the additional mitigation set out in the SSSI Mitigation Strategy (Appendix 10.35) the magnitude of impacts would be Minor Adverse and the significance of effects Slight or Moderate in the medium term. In the long term the magnitude would be Negligible Adverse and the significance Slight.

10.8.15 The effects on the interest features of the SSSIs that occur in the vicinity of the new section of motorway and that could be affected are assessed under the individual VERs below. These are as follows.

River Usk (Lower Usk) SSSI

- Otter.
- Migratory fish (river and sea lamprey, twaite shad, salmon, eel, sea trout and allis shad) and assemblage of fish species.

Severn Estuary SSSI

- Internationally important populations of migratory and wintering bird species and waterfowl.
- Migratory fish (river and sea lamprey, twaite shad, salmon, eel, sea trout and allis shad) and assemblage of fish species.

Mwyngloddfa Mynydd-Bach SSSI

- Lesser horseshoe bat winter hibernation roost.
- Lesser horseshoe and greater horseshoe bats.

Wye Valley Lesser Horseshoe Bat SSSI

- Lesser horseshoe bat summer roosts.
- Lesser horseshoe and greater horseshoe bats.

Gwent Levels SSSIs

- Reen and ditch habitat (Eutrophic standing waters).
- Aquatic insects and other invertebrates.
- Shrill carder bee.

Newport Wetlands SSSI

- Internationally important populations of migratory and wintering bird species and waterfowl.

Non-statutory Designated Sites

10.8.16 The non-statutory designated sites and ancient woodlands in the vicinity of the new section of motorway are shown on Figure 10.3. As explained in Section 10.7 a number of non-statutory designated sites would be directly affected by the permanent land take for the new section of motorway. Non-statutory sites within which there would be additional land take for construction, other than narrow strips along the margin of the permanent land take, would be from west to east, the Afon Ebbw River SINC, Marshall's SINC and Spencer Works 3 SINC.

10.8.17 Each of the SINCs where there would be additional land take for construction is considered in turn.

10.8.18 Afon Ebbw River SINC. The designated site is confined to the channel of the river itself. In addition to the permanent works for the new viaduct supports and drainage outfalls referred to in Section 10.7 there would be additional areas for construction within saltmarsh adjacent to the SINC. As for the permanent works there would be very minor incursion into the SINC.

10.8.19 Marshall's SINC. The designated site largely comprises the saltmarsh on the east bank of the River Usk together with a large pond and areas of industrial land. In addition to the land for the permanent works, there would be additional land take for construction within the saltmarsh and in areas of industrial land to the east.

10.8.20 Spencer Works 3 SINC. This site is located in the Tata Lagoons area and is designated for marshy grassland with wet drains. In addition to the permanent land take which would remove a series of embankments and drains forming the southern part of the site, there would be further loss for construction comprising an area of scrub in the east of the SINC. The combined effect of the temporary and permanent land take would be the removal of most of the vegetation within the SINC.

Assessment of Potential Effects

10.8.21 The additional land take for construction within the Marshall's SINC would comprise some 0.49 ha of saltmarsh (also within the River Usk SAC and River Usk (Lower Usk) SSSI as referred to above) and areas of industrial land of minimal ecological value. The Scheme includes mitigation for loss of saltmarsh by creation of new saltmarsh habitat as explained in Section 10.5. The EMP (Figure 2.6) includes 7.06 ha of scrub which would assist in mitigating for the loss of the additional area of the Spencer Works 3 SINC required for construction.

10.8.22 In the absence of mitigation, other than that which forms part of the Scheme, the magnitude of the additional loss of SINCs (County (Medium) value) for construction use is assessed as Minor Adverse and the significance of effects as Slight in the medium and long term.

Assessment of Effects with Additional Mitigation

10.8.23 No additional mitigation is proposed for the construction land take within the SINCs. The assessment of the magnitude of the additional loss of SINCs thus remains as Minor Adverse and the significance of effects as Slight in the medium and long term.

Nature Reserves

10.8.24 The nature reserves in the vicinity of the new section of motorway are the Newport Wetlands NNR and RSPB Nature Reserve, and the Magor Marsh and Great Traston Meadows Gwent Wildlife Trust Nature Reserves. The construction of the new section of motorway would not result in additional land take from any of these nature reserves. Unlike the other designated sites, nature reserves have a role as public amenities and the effects of the new section of motorway on this aspect of the nature reserves is considered in Chapter 15: Community and Private Assets.

10.8.25 Given their distance from the new section of motorway, adverse effects on the ecology of either Magor Marsh Nature Reserve or Newport Wetlands Nature Reserve as a result of construction activities are unlikely (No change). There could be some disturbance from construction in the north western part of Great Traston Meadows Nature Reserve (County (Medium) value). This is likely to be of Minor Adverse magnitude and Slight significance. No additional mitigation is proposed.

Rivers (Usk and Ebbw)

10.8.26 The Rivers (Usk and Ebbw) Ecological Unit includes the following VERS.

- Rivers.
- Sub-tidal benthic habitat.
- Intertidal mudflats.
- Coastal saltmarsh.
- Migratory fish.
- Estuarine fish assemblage.

10.8.27 The overall construction impacts of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme. Then the impacts on each of the relevant VERs are assessed.

Temporary Habitat Loss

10.8.28 There would be no temporary loss or disturbance of Rivers, Sub-tidal benthic or Intertidal mudflat habitats as a result of the construction compounds for the River Usk Crossing or for the River Ebbw Underbridge.

10.8.29 As explained under Land Take in Section 10.7, in addition to the permanent loss of some 0.42 ha of coastal saltmarsh, a further 1.01 ha would be temporarily lost and disturbed as a result of the construction compounds for the River Usk Crossing and for the River Ebbw Underbridge.

10.8.30 Most of the River Ebbw saltmarsh conforms to the NVC SM13 *Puccinellia maritima* saltmarsh, and this was also found in creeks in the River Usk although diversity was on the whole lower in the River Usk. *P. maritima* is a pioneer species and therefore may be expected to colonise relatively quickly as seed but primarily as vegetative fragments and would be likely to regrow from plant fragments left in the soil. The rate of recovery would however depend on the degree of sediment disturbance. Most infaunal species associated with the saltmarsh can burrow back into sediment, but may suffer significant predation as a result of being removed from the sediment (Tyler-Walters, 2004). Polychaetes would probably recolonise habitats by a mixture of migration (swimming) and passive transport and this is likely to be rapid for some species such as *H. diversicolor*. Overall, vulnerability/intolerance is considered to be high and, where disturbance is slight, recovery is likely to be rapid (i.e. less than 6 months). However, where the sediment has been disturbed and plants lost, recovery of plant communities together with infauna may take between four and ten years (Tyler-Walters, 2004).

Potential Effects of Pollution from Inappropriate Storage of Chemicals or Spillages

10.8.31 As explained in Section 10.7, there would be no construction in the wetted channel of the River Usk or River Ebbw (defined as the channel below Mean High Water as explained in Chapter 2: Scheme Description. Adherence to the measures to be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) and the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), the Outline Ground and Surface Water Management Plan (Annex G to Appendix 3.2), standard best practice guidance and Environment Agency Pollution Prevention Guidelines would significantly reduce the likelihood of an accidental pollution incident occurring and impacting the watercourses of the Rivers Usk and Ebbw. In the unlikely event that pollutants did enter these watercourses during the construction phase they would be rapidly dispersed on the surface and in the water column and subject to twice daily tidal flushing, and so any effects on river water quality would be limited.

10.8.32 As explained in Chapter 16: Road Drainage and the Water Environment, any potential pollution effects that may result from the construction of the piled tower foundations, including groundwater control measures associated with the use of cofferdams would thus be mitigated. By undertaking site-specific piling assessment the potential for creating new pathways with the potential to result in cross contamination would be minimised.

10.8.33 There is a risk that pollution may accidentally be released into the River Usk and River Ebbw during construction as a result of the following.

- River bank works/construction compounds including the operation of bentonite plant/polymer plants to support pile installation.
- Bridge construction above the watercourses.
- Earthworks near to the rivers, and connected reens and ditches.
- Use of vehicles and machines near the watercourses.
- Spoil / storage heaps near the watercourses.

- Storage and use of chemicals, oil, concrete and cement in or near the watercourses.
- Disposal of water from construction activities.
- Accidental spillages or leakages.

10.8.34 Pollution may include diesel oil, leachates from cements and/or grouts used in construction, synthetic chemicals and bentonite muds used in pile boring. However, given the mitigation included within the Scheme, the likelihood of accidental release of such contaminants is considered to be extremely low. Appropriate measures to be outlined in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) and the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2) would include: designating areas for refuelling; storage of chemicals in secure designated areas in line with appropriate regulations and guidelines; double skinning of any tanks and pipes containing hazardous substances; and storage of hazardous substances in impervious bunds. Adherence to these measures, standard best practice guidance and Environment Agency Pollution Prevention Guidelines would significantly reduce the likelihood of an accidental pollution incident occurring.

10.8.35 Coastal saltmarsh habitats are typically low energy environments with the sediments often acting as sinks for contaminants; the species present are considered likely to have an intermediate to high intolerance to contamination and a moderate to very high potential for recovery (Tyler-Walters, 2004). Trampling and disturbance caused by clean-up operations may also increase the levels of damage in the event of an accidental pollution event. In the event of a spill of bentonite, an inert, non-toxic material, the greatest impact would likely arise from localised and temporary smothering of saltmarsh species, and although the majority of plant species would be unlikely to be adversely affected due to the height of the swards, infaunal species associated with the habitat may be lost (Tyler-Walters, 2004).

10.8.36 Accidental spillage of chemicals and substances from construction compounds and activities (including vehicles and equipment operating near to watercourses and the drilling mud plants) may impact on migratory fish species, resulting in behavioural effects such as avoidance of affected areas and barriers to migration. Chemical spills may also have sub-lethal to lethal effects dependent on the spatial and temporal extent of the exposure and the level of toxicity. However, the risk of such events occurring will be minimised through adherence to the measures to be set out in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) as referred to above. These measures would significantly reduce the likelihood of an accidental pollution incident occurring.

10.8.37 The sensitivity of migratory fish species will vary depending on a range of factors including the pollutant, species and life stage involved with fish eggs and larvae likely to be particularly sensitive (Westernhagen, 1988). As only adult and juvenile migratory fish species are likely to be in the vicinity of the construction works for the River Usk Crossing, and in most cases only transiting during this time, they are considered less likely to be affected by marine pollution due to their increased mobility. There is also evidence that fish have the ability to detect (and therefore avoid) oil contaminated waters through olfactory (smell) or gustatory (taste) systems (DCENR, 2011). Sea lamprey for example are known to be sensitive to pollution, though some pollution in the lower reaches of rivers

appears to be tolerated, and migrating adults can pass through such waters to reach their spawning grounds in cleaner water upstream (Maitland, 2003).

10.8.38 In comparison to migratory fish species which intermittently transit through the estuaries of the River Usk and River Ebbw, and would therefore only be temporarily and intermittently exposed to accidental pollution/spillages, resident estuarine species in these rivers may be more susceptible. This may be particularly relevant for species such as plaice, sole and whiting whose nursery grounds may coincide with shallow waters in the lower reaches of the River Usk and the River Ebbw. The risk of such events occurring would, however, be minimised through adherence to the measures to be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), standard best practice guidance and Environment Agency Pollution Prevention Guidelines as referred to above.

Potential Effects of Runoff

10.8.39 The Rivers habitat within the estuaries of the River Usk and River Ebbw has naturally very high suspended loads. Adherence to the measures to be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) and the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), the Outline Ground and Surface Water Management Plan (Annex G to Appendix 3.2), standard best practice guidance and Environment Agency Pollution Prevention Guidelines would significantly reduce the likelihood of additional particulate inputs impacting on the watercourses of the Rivers Usk and Ebbw.

10.8.40 There is the potential for runoff from the construction areas for the River Usk and River Ebbw crossings to affect coastal saltmarsh habitat in both the River Usk and River Ebbw as a result of smothering by particulates. Key saltmarsh plants such as *Puccinellia maritima* are, however, likely to be tolerant to accretion rates of 5 cm per year (Packham and Willis, 1997), although in the more heavily sheep-grazed areas of saltmarsh on the banks of the River Ebbw, some vascular plant species may be more vulnerable. The associated burrowing infaunal communities are likely to be similarly tolerant to a degree of smothering by particulate matter/sediments (Tyler-Walters, 2004).

10.8.41 Excessive fine sediment, in suspension or deposited, can have damaging impacts on all life stages of fish. However, as with effects associated with contamination and pollutants, the effects of particulate matter pollution (i.e. increased suspended solid concentrations) as a result of runoff from construction areas near the River Usk and River Ebbw sediment on migratory fish will vary depending on life stage, time of year, size of fish, the composition of the particulates and the availability of unaffected habitat (Bash *et al*., 2001).

10.8.42 Effects associated with particulates are especially damaging for fish eggs and larvae/fry (Robertson *et al*., 2006) and therefore have implications for spawning success for migratory fish species. With respect to the adult life and juvenile stages temporarily transiting through the estuaries of the River Usk and River Ebbw, it is known that fish exhibit avoidance reactions and move away from the vicinity of adverse sediment conditions if refuge conditions are present (Sigler *et al.,* 1984; Bash *et al*., 2001) and could therefore potentially move to avoid any unfavourable discharges of particulate matter (Robertson *et al*., 2006). Fish are also known to tolerate high levels of suspended sediments and migrating fish

species, such as salmonids, are commonly known to migrate through high suspended sediment concentrations in estuaries (Salmon and Trout Association, 2015) including those regularly encountered in the Severn Estuary. High exposure rates to sediment loads can however halt fish migration, particularly upstream.

10.8.43 Fish are sensitive to increases in particulate matter (i.e. suspended sediment concentrations), both directly, through physiological and behavioural disruption, and indirectly, through habitat modification (e.g. smothering of spawning/nursery habitats), increased suspended solids can impair foraging, increase mortality, affect growth, reproduction and survival at all trophic levels. However, for estuarine fish there is also evidence to indicate that high sediment loads and associated turbidity found in natural ecosystems can create feeding opportunities for some species such as demersal fish (Henley *et al*., 2000). No spawning grounds are thought to occur in the vicinity of the works and so significant impacts on fish eggs and larvae are unlikely although a number of species may have nursery habitats in the vicinity of the proposed works and therefore some juvenile fish (e.g. plaice, sole and whiting) may be vulnerable.

Noise and Vibration from Piling Leading to Disturbance/Barrier Effects to Migratory and Estuarine Fish

10.8.44 As explained in Appendix 13.3 Construction Noise and Vibration Assessment, vibration arising from construction activities can result in groundborne noise. Whilst levels re-radiated into the air would be relatively low, there may be ecological effects where noise is re-radiated into a watercourse. The installation of sheet and bored piles associated with the pylon construction for the River Usk Crossing may result in ground-borne noise and vibration. These activities may generate some noise that would pass through the ground and subsequently into the watercourse. Although airborne noise levels are predicted and presented within the noise assessment, no such information is available for the likely underwater noise levels.

10.8.45 There is a lack of information relating to the effect of groundborne noise from vibratory piling being transmitted into the water. However, it is considered highly likely that noise levels would be significantly lower than for impact piling.

10.8.46 No construction works associated with the River Usk Crossing would be carried out within the wetted channel (defined as the channel below Mean High Water of either the River Usk or the River Ebbw (as explained in Chapter 2: Scheme Description), therefore, noise and vibration would not be generated as a result of piling directly within the marine environment. There would, however, be the potential for noise from the installation of piles on land on the banks of these rivers, and in the vicinity, to transmit through the ground to the water column of the estuarine environment, although these pathways are less well understood than those in which sound is generated directly into the water. Furthermore, studies on whether onshore piling has any impact on fish are very limited. Therefore, as a highly precautionary worst case scenario the assessment has been undertaken on the basis that the sound generated would not be moderated by the ground conditions (i.e. as though the piling were taking place in water).

10.8.47 As explained in the Buildability Report (Appendix 3.1) for the construction of the River Usk Crossing, sheet piles would be required for the east pylon cofferdam. Installation of the coffer dam would take some eighteen days but use of the

vibrator would not be continuous. The east and west pylons for the River Usk Crossing would each require the installation of 26 x 2.1 m piles. Temporary casings for the piles for the east and west pylons themselves and for the and east and west approach viaducts would be vibrated through the made ground and estuarine alluvium to the top of the Mercia Mudstone. The piling rig would then be positioned over the casing and the contents drilled out using augers and digging buckets as necessary following which the piles would be constructed within the casings. The process of installing these piles has the potential to result in underwater noise and vibration effects on fish species, including potential barrier effects to migration.

10.8.48 As explained in the Buildability Report (Appendix 3.1) in order to mitigate the levels of noise and vibration generated by the piling works, a variable moment, frequency vibrator could be used to drive and extract the temporary casings. This type of vibrator has an advantage over a fixed moment unit in that no low frequency vibrations are generated at any time during the work cycle. The machine is allowed to accelerate to maximum operating speed prior to the vibrating action commencing and vibrating is halted prior to the machine stopping. This results in a mode of operation more suitable for sensitive sites.

10.8.49 The operation of the vibrator at the pylon locations would only be required for periods of approximately 15 – 20 minutes during casing installation for each pile, and similar periods during subsequent extraction. Boring of each of the piles would take approximately a day. Allowing for installation of casings, bore piling and removal of casings it is likely that three piles would be completed per week.

10.8.50 For all piling works associated with the east and west pylons, noise and vibration associated with these activities would represent intermittent occurrences over five months within a single year (currently planned for 2018). Piling would be carried out over a 10 hour day, so most would take place during daylight hours

10.8.51 To a lesser extent, the installation of piles for the west and east approach viaducts would also have the potential to result in underwater sound and vibration effects on fish species. As above for the River Usk bridge pylons, all viaduct piles would be installed via a combination of vibropiling (for the insertion of the temporary casings) followed by boring/drilling used to excavate the contents of the temporary casings. Piling operations for the east and west approach viaducts would each take six months. In addition five test piles would be installed in advance of the permanent piles.

10.8.52 As explained in the Buildability Report (Appendix 3.1), the River Ebbw bridge, bored *in-situ* reinforced concrete piles would be installed for the piers and abutments. A total of around 200 piles would be required and would be installed at a rate of around four per day. It is likely that the temporary sheet piling for the associated pilecaps would be installed using a vibrohammer.

10.8.53 As explained in Appendix 13.3 Construction Noise and Vibration Assessment, the variable moment, frequency vibrator selected to drive the piles for the cofferdam and the pile casings has an advantage over a fixed moment unit in that no low frequency vibrations are generated at any time during the work cycle. Vibropiling generates continuous broadband sound; the Compendium of Pile Driving Sound Data (CPSD) (Illingworth and Rodkin, 2007) reports on sound levels measured during vibratory driven sheet piling (such as would be used for the cofferdams)

for a port project in water approximately 12 to 14 m deep as approximately 173 dB r.m.s re µPa at frequencies of 400 to 2,500 Hz.

10.8.54 Although considerable variation is likely based on location and equipment used, on this basis, construction of the cofferdams using vibropiling may not generate underwater sound levels significantly greater in magnitude than an individual small watercraft, although it should be noted that the overall duration would be longer in any given day. This is supported by noise monitoring during vibropiling at Red Funnel's Southampton Terminal in Southampton Water, where source levels of the vibrohammer could not be discerned from the background level of vessel noise (approximately 150 dB re 1 µPa) in the area (Nedwell *et al*., 2003).

10.8.55 Bored foundation piling is considered unlikely to generate significant underwater sound levels. Although measurements for bored piling are not reported in the CPSD, the 'Review of Existing Data on Underwater Sounds Produced by the Oil and Gas Industry' (Wyatt, 2008) provides received sound levels from an oil and gas exploratory drilling ship in water 110 m deep, which may be considered to be an over-estimate of sound emissions for a land-based bored piling site. These data indicate source levels could be in the order of 141 dB r.m.s re 1 µPa, which may generate received levels below ambient levels in the river; even at short distances.

10.8.56 In summary, all piling installation works would be restricted to daytime working hours (i.e. no night time pile installations) and vibropiling would occur intermittently over a five month period and would generate noise similar to that from a small vessel. Bore piling would occur intermittently over a six month period with no significant underwater sound generated within the rivers.

10.8.57 The pathways by which noise generated on land may transmit through the ground to the water column of the estuarine environment are poorly understood and therefore a precautionary approach has been adopted to the assessment drawing on data from similar piling undertaken in water.

10.8.58 As explained in the Buildability Report (Appendix 3.1), test piles are to be installed ahead of the working piles so that the designer has sufficient information to validate the pile design. At the east and west pylon locations the test piling would be done in areas adjacent to, but outside of, the pile cap footprints.

10.8.59 As explained in Appendix 13.3 Construction Noise and Vibration Assessment, during the installation of the test piles a programme of noise and vibration monitoring would be carried out, including noise transmitted through the ground to the water's edge, and ground vibration at agreed monitoring stations between the vibration generator and the water's edge. The results of such monitoring would indicate whether the installation of working piles would conform to appropriate noise and vibration level limits and whether additional mitigation measures may be required.

10.8.60 The migratory fish species which have the potential to be impacted by all piling events are twaite and allis shad, Atlantic salmon, sea lamprey, river lamprey European eel and sea trout. Brook lamprey will not be impacted by construction noise in, and in the vicinity of the Usk Estuary, as this species does not use estuarine waters.

10.8.61 The impacts of noise on fish can broadly be split into lethal and physical injury, auditory injury and behavioural response. Hearing loss can comprise a

temporary reduction in hearing sensitivity (i.e. temporary threshold shift (TTS)). Longer term hearing loss may be mitigated by the addition over time of new hair cells and for TTS, normal hearing often returns after cessation of the sound causing the TTS. At sound levels lower than those that may cause physical injury or mortality, noise may also cause behavioural effects on a species, for example, avoidance of an area or changes in swimming speed (Mueller-Blenke, 2010). This may be significant if it causes, for example, fish of a migratory species to be delayed or diverted from their course.

10.8.62 Most fish species are capable of hearing within a frequency range of 50 Hz up to 500 to 1,500 Hz. A smaller number of species (notably clupeids) can detect sounds to over 3 kHz while a very few species can detect sounds to well over 100 kHz (Popper and Hastings, 2009). Fish can be grouped into the following categories based on the presence or absence of a swim bladder and on the potential for that swim bladder to improve the hearing sensitivity and range of hearing (Popper *et al*., 2014).

- Fish with no swim bladder or other gas chamber (e.g. lampreys, elasmobranchs, dab and other flatfish). These species are less susceptible to barotrauma and only detect particle motion, not sound pressure. However, some barotrauma may result from exposure to sound pressure.
- Fish with swim bladders in which hearing does not involve the swim bladder or other gas volume (e.g. Atlantic salmon). These species are susceptible to barotrauma although hearing only involves particle motion, not sound pressure.
- Fish in which hearing involves a swim bladder or other gas volume (e.g. Atlantic cod, herring and relatives). These species are susceptible to barotrauma and detect sound pressure as well as particle motion.

10.8.63 Most acoustic energy from vibropiling piling is emitted at low frequencies of 400 - 2,500 Hz producing an effectively continuous sound (rather than impulsive as generated during impact piling for example); the sensitivity of fish species to higher frequencies is not therefore likely to be as relevant to the impact assessment as sensitivity to mid frequency ranges (i.e. <1,500 Hz).

10.8.64 The migratory fish species/life stages with the greatest sensitivity to underwater noise are adult twaite shad and adult allis shad (both species in which the swim bladder is involved in hearing) during their upstream migrations in March to June, and juvenile Atlantic salmon (fish with swim bladders in which hearing does not involve the swim bladder) during their downstream migration in April to June. Although these species are present in the estuary at other life stages (e.g. juvenile shad migrating downstream and adult Atlantic salmon), the aforementioned life stages are considered to be the most sensitive to potential barrier effects/disruption to migration as a result of noise and vibration. Atlantic salmon undertaking upstream migration, sea lamprey (upstream and downstream migration) and river lamprey (all life history stages) and allis and twaite shad (juvenile downstream migration and feeding), are considered to be less sensitive (although it should be noted that these species are still considered to be sensitive at these life stages).

10.8.65 The period of highest sensitivity for underwater noise related impacts on migratory fish in the River Usk is considered to be March to June (inclusive). Therefore, although the source levels associated with the vibropiling and bore

piling are likely to be low, based on a precautionary approach, piling works undertaken during this period (notably for the east and west pylons and associated cofferdams and potentially also for the viaduct piles) either side of the River Usk would represent a risk to key migratory species.

10.8.66 This assessment has been based on the interim sound exposure guidelines for continuous sounds proposed by Popper *et al*. (2014) using current information. In some cases, such as for recoverable injury and TTS in fish possessing swim bladders involved in hearing, numerical guidelines are provided. However, in most instances, numerical guidelines do not exist because of lack of data, therefore, the relative likelihood of effects occurring for three distances from the source - near (i.e. tens of metres), intermediate (i.e. hundreds of metres) and far (i.e. thousands of metres) - were assessed in Popper *et al*. (2014). For the purposes of this assessment, the near field can be assumed to be those piles associated with the east pylon on the bank of the River Usk, whereas the intermediate field can be assumed to include the remaining piles required for the River Usk Crossing (i.e. for the piles associated with the east and west approach viaducts and the east and west abutments).

10.8.67 On the basis of the Popper *et al*. (2014) guidelines, together with the magnitude of the noise likely to be generated as a result of vibro and bore piling, the risk to all fish, including migratory fish, from mortality and potential mortal injury as a result of the continuous sound produced by the vibratory piling, even in close proximity to the source (i.e. tens of metres) is considered to be low.

10.8.68 According to the relative likelihood of behavioural effects occurring, as proposed by Popper *et al*. (2014), the risk of twaite and allis shad experiencing behavioural effects in the near field (i.e. associated with vibropiling for the east pylon and cofferdam) is high and for Atlantic salmon is moderate. The duration of this piling would be intermittent over six months and therefore although short term effects may occur, it is not likely to create a barrier to migration in the medium to long term. During vibropiling at Red Funnel's Southampton Terminal in Southampton Water, monitoring of caged trout revealed no evidence that trout reacted to the vibropiling even at a close range of less than 50 m. It should be noted however that trout are expected to be less sensitive to piling than salmon (Nedwell *et al*., 2003).

10.8.69 Sea lamprey have been reported to respond to low frequencies (20-100 Hz) (Lenhardt and Sismour, 1995), though it has been suggested that sound may not be relevant to these species at all (Popper, 2005). Therefore, although uncertain, the sensitivity of sea lamprey to underwater noise and vibration is likely to be less than that for shad and Atlantic salmon.

10.8.70 The upper audible frequency limit in European eel is approximately 300 Hz (Jerkø *et al*., 1989). At low frequencies the relevant stimulus parameter is particle motion, excluding involvement of the swimbladder. At the higher frequencies within the audible range, Jerkø *et al*. (1989) observed that the swimbladder conveys an auditory advantage for stimuli with a high ratio between pressure and particle motion. Simpson *et al*. (2014) demonstrated that acoustic disturbance can compromise antipredator behaviour in, and therefore the survival of, European eel. Juvenile European eel exposed to playback of recordings of ships passing through harbours, were 50% less likely and 25% slower to startle to an 'ambush predator' and were caught more than twice as quickly by predators. Eel exposed to additional noise had diminished spatial performance

and elevated ventilation and metabolic rates (indicators of stress) compared with control individuals (Simpson *et al*., 2014). The hearing range of European eel is however likely to be below the range of frequencies that are likely to be generated by the vibropiling) but does overlap with the dominant frequencies of ship noise. Behavioural effects are therefore not likely as a result of the proposed piling works associated with the new section of motorway.

10.8.71 During 2013, a total of 720 cargo vessels were received at Newport Docks (Global Maritime Consultancy Ltd, 2015). As the noise likely to arise from the vibropiling is predicted to be of a similar nature to that of a small work boat and noise associated with larger cargo vessels will be higher (Wyatt, 2008), then some habituation to noise is likely for the fish assemblage in the area. However, this may not be true of migratory species and furthermore the sound levels generated by the piling, albeit intermittent, would be of greater frequency of occurrence than those associated with vessel traffic.

10.8.72 Responses of fish to underwater noise include lethal and physical injury, auditory injury and behavioural responses, the latter of which includes a range of responses such as changes in swimming and schooling behaviour. The behavioural responses of estuarine fish will, however, depend on the life stage of the fish and the drivers for being in the area (e.g. feeding, spawning). The sensitivity of fish to underwater noise will also depend on the presence or absence of a swim bladder and on the potential for that swim bladder to improve the hearing sensitivity and range of hearing (Popper *et al*., 2014).

10.8.73 As stated above for migratory fish, the risk to all estuarine fish, from mortality and potential mortal injury as a result of the continuous sound produced by the vibratory piling, even in close proximity to the source (i.e. tens of metres) is considered to be low. The risk of behavioural responses is considered to be moderate (Popper *et al*., 2014) for the estuarine fish assemblage and, should they occur, may be sufficient to result in some temporary avoidance of areas of the River Usk, with some temporary redistribution of fish in the wider area. Such effects would however be temporary and intermittent during the construction phase and normal fish behaviour and distribution would likely resume in between piling events with no long term effects.

Artificial Lighting Causing Behavioural/Barrier Effects

10.8.74 Artificial lighting would be used during the construction phase both to illuminate required works, as necessary, and to mark structures for public safety. There is therefore potential for artificial light spill to impact fish in the Rivers Usk and Ebbw during construction, and in particular the behaviour and movement of migratory fish through these rivers.

10.8.75 Artificial lighting may disorient migrating fish, effectively presenting a barrier to migration. In the absence of light, migratory fish, such as salmonids, travel quickly through large rivers (Økland *et al*., 2001) that are more likely to have sub-optimal temperatures or increased pollutants, but the disorientation caused by lights could increase the time these fish spend in polluted environments and, as a result, increase their risk of mortality (McCormick *et al*., 1998).

10.8.76 Eels, for example, are strongly photophobic (Bruijs and Durif, 2009) and studies have documented strong avoidance reactions to light. Both the movement of glass eel and elver into freshwaters and of pubescent silver eel to sea typically

occur at night (Bruijs and Durif, 2009), and light falling onto their migratory pathway may have a marked obstructive effect on their movement (Sörensen, 1951; Hadderingh *et al*., 1992). In salmonids, the downstream smolt migration usually takes place during the night, which is likely to be an anti-predator tactic (Riley *et al*., 2012). The emergence and dispersal of fry from spawning redds (the term for a salmon spawning nest) also occurs primarily at night and the synchronous nature of these events is a predator avoidance tactic (review in Riley *et al*., 2013). The dispersal of fry has however been shown to be both delayed and disrupted by 12 lux intensity street lamps (Riley *et al*., 2013) and similarly at lower intensity light levels of 1 to 8 lux (Riley *et al*., 2015).

10.8.77 Artificial night light may influence foraging and shoaling behaviour of estuarine fish, predation risk and reproduction; although responses vary greatly between species, age classes and environment (Nightingale *et al*., 2006). Many predatory fish rely on visual cues to locate and capture prey. Therefore, artificial light emanating from coastal infrastructure has the potential to alter the feeding behaviour of predatory fish. Light can affect prey fish behaviour, particularly with regards to schooling, with fish more likely to form schools under elevated light conditions. Therefore, there is the potential for predator-prey interactions to be affected. Studies have shown that the effects of artificial night time lights on fish assemblages within an estuarine ecosystem include an increase in the abundance of small fish as well as large predatory fish, likely as a result of attraction to optimised feeding conditions (Becker *et al*., 2013).

10.8.78 As explained in Section 10.5 referring to Chapter 3 Scheme Constructon, 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 during the night time. Such task lighting would be positioned at low level on posts and directed at the most frequently used areas of work.

10.8.79 Inward facing security lighting would be provided at construction compounds on a 24 hour basis.

10.8.80 As explained in Chapter 3: Scheme Construction a more detailed lighting strategy for the construction period would be developed to identify the type of lighting to be used and measures to be implemented to reduce light spill. The strategy would be agreed with the local planning authority and the regulator.

Rivers

10.8.81 Although mitigation measures to prevent pollution designed into the Scheme would reduce the risk of any adverse effects on the rivers, a short term measurable effect cannot be entirely precluded. The Rivers habitat of the River Usk is of National (High) value based on the SSSI designation. Although also included in the River Usk SAC, the tidal river habitat is not an SAC feature. The River Ebbw is of County (Medium) value.

10.8.82 The Rivers habitat within the estuaries of the River Usk and River Ebbw has naturally very high suspended loads. Adherence to the measures to be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) and the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), the Outline Ground and Surface Water Management Plan (Annex G to Appendix 3.2, standard best practice guidance and Environment Agency Pollution Prevention

Guidelines would significantly reduce the likelihood of additional particulate inputs impacting the watercourses of the Rivers Usk and Ebbw.

Assessment of Potential Effects

10.8.83 The assessment takes into account the mitigation measures which are incorporated into the Scheme to minimise the risk of accidental pollution events and particulate pollution during construction (i.e. avoidance of construction in the wetted channel of the rivers (defined as the channel below Mean High Water as explained in Chapter 2 Scheme Description, the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) and the other measures referred to above. The magnitude of the impacts is assessed as Minor Adverse and the significance of effects as Slight or Moderate for the River Usk (National (High) value) and Slight for the River Ebbw (County (Medium value).

Assessment of Effects with Additional Mitigation

10.8.84 The mitigation measures which are incorporated into the Scheme are considered to be sufficient to manage the risk to the Rivers habitat during construction; no additional mitigation measures are proposed.

10.8.85 The magnitude of the impacts of accidental pollution on Rivers would remain as Minor and the significance of effects as Slight or Moderate for the River Usk and Slight for the River Ebbw.

Sub-tidal Benthic Habitat

10.8.86 The intolerance of these communities to pollution is considered to be intermediate, recoverability high and overall sensitivity to the likely contaminants would be low (Hiscock, 2002).

10.8.87 The subtidal benthic habitats within the estuaries of the River Usk and River Ebbw are naturally subject to, and therefore tolerant of, regular very high background suspended loads. As many of the benthic species are capable of burrowing through sediment, sensitivity to the deposition of particulate matter is low (Hiscock, 2002).

Assessment of Potential Effects

10.8.88 Taking into account the mitigation measures that are incorporated into the Scheme design to minimise the risk of accidental pollution events during construction (i.e. the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) and the other measures referred to above) and given the unlikelihood of a pollution event occurring, and the naturally high sediment loads in the rivers Usk and Ebbw, the magnitude of the impact on subtidal benthic habitat (receptor of National (High) value – River Usk; County (Medium) value – River Ebbw) is assessed as Negligible Adverse and the significance of effect as Neutral or Slight (River Ebbw) and Slight (River Usk).

Assessment of Effects with Additional Mitigation

10.8.89 The mitigation measures which are incorporated into the Scheme are considered to be sufficient to manage the risk to subtidal benthic habitat during construction; no additional mitigation measures are proposed. The magnitude of the impact of accidental pollution on subtidal benthic habitats would remain as Negligible

Adverse and the significance of effects as Neutral or Slight (River Ebbw) and Slight (River Usk).

Intertidal Mudflats

10.8.90 Intertidal sediments are generally more susceptible to chemical pollution than high energy coastal environments. Furthermore, the low dispersion within these areas may result in them acting as sinks for pollutants and heavy metals, as a result of them becoming adsorbed onto fine sediments and organic particulates (Clark, 1997). Hydrocarbon contamination from oil spills in particular, often results in large-scale damage to intertidal communities due to smothering of sediments which prevents oxygen exchange and leads to anoxia and subsequent death of infauna (Tyler-Walters and Marshall, 2006). The intolerance of component species to impacts of this nature is typically high, and bivalves in particular may experience mortality following an accidental contamination event. Recovery of the sediment requires dilution, biodegradation or removal of the contaminant from the sediments. Therefore chemicals may persist for some time and it is likely that severe contamination will lead to declines in species richness although recoverability will typically be high (Rayment, 2001).

10.8.91 There is the potential for runoff from the construction areas for the River Usk and River Ebbw crossings to affect intertidal mudflats in both the River Usk and River Ebbw as a result of smothering by particulates. The important characterising species are however infaunal and capable of burrowing upwards to the surface (Rayment, 2001). Any effects would be temporary and short lived with the majority of particulate matter likely to be dispersed on the next high tide. Runoff and any associated particulate matter, should this occur during high tide, would be expected to be rapidly dispersed on the tide/river stream.

Assessment of Potential Effects

10.8.92 There would be no temporary loss or disturbance of intertidal mudflat.

10.8.93 Taking into account the mitigation measures to minimise the risk of accidental pollution events which are incorporated into the Scheme design via the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) and the other measures refered to above, and given the unlikelihood of a pollution event occurring, the magnitude of the impact of accidental pollution or smothering from particulate matter on intertidal mudflats (receptors of Medium value (River Ebbw) to High value (River Usk) is assessed as Negligible and the significance of effect as Neutral or Slight (River Ebbw) and Slight (River Usk).

Assessment of Effects with Additional Mitigation

10.8.94 The mitigation measures to minimise the risk of accidental pollution events which are incorporated into the Scheme are considered to be sufficient to manage the risk to intertidal mudflats during construction; no additional mitigation measures are proposed. The magnitude of the impact of accidental pollution on intertidal mudflat habitats would remain as Negligible and the significance of effects as Neutral or Slight (River Ebbw) and Slight (River Usk).

Coastal Saltmarsh

10.8.95 In addition to the permanent land take for the east pier of the River Usk Crossing and the supports for the River Ebbw Underbridge, as described in Section 10.7 a total of 1.01 ha of coastal saltmarsh habitat would be affected by the construction of the crossings. In the case of the River Usk the effects on the area of saltmarsh affected would be temporary and reversible and the mitigation measures described in Section 10.5 would facilitate the recovery of the saltmarsh communities after construction has ceased. It is estimated that full recovery may take up to ten years.

10.8.96 However, at the River Ebbw, the height of the soffit of the bridge would result in shading of the saltmarsh and would be sufficient to reduce the growth of vegetation beneath the bridge. So on a precautionary basis it is assumed that all of this saltmarsh would be permanently lost.

10.8.97 These effects are assessed under land take in Section 10.7 and the assessment below relates to the other potential construction impacts.

Assessment of Potential Effects

10.8.98 Taking into account the mitigation measures which are incorporated into the Scheme and which would minimise the risk of accidental pollution events and particulate discharges during construction (i.e. the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) and the other measures referred to above, pollution events which would affect coastal saltmarsh would be unlikely to occur. The rivers have naturally high sediment loads and so particulate matter in runoff from construction areas onto saltmarsh is unlikely to result in adverse effects.

10.8.99 The magnitude of the impact of construction on coastal saltmarsh habitats in the absence of mitigation, other than that which is integral to the Scheme, is assessed as Minor Adverse in the medium term and the significance as Slight for saltmarsh within the River Ebbw (receptor of Medium value) and Slight or Moderate for saltmarsh within the River Usk (receptor of High value). In the long term the magnitude of impacts would be Negligible and the significance of effects Neutral or Slight for the River Ebbw saltmarsh (County (Medium) value) and Slight for the River Usk saltmarsh (National (High) value).

Assessment of Effects with Additional Mitigation

10.8.100 The mitigation measures which are incorporated into the Scheme would minimise the risk of accidental pollution events and particulate discharges during construction and no additional mitigation measures are proposed.

10.8.101 The magnitude of the impact of construction on coastal saltmarsh habitats would thus remain as Minor Adverse in the medium term and the significance of effects as Slight for saltmarsh at the River Ebbw (receptor of Medium value) and the significance of effects as Slight or Moderate for saltmarsh at the River Usk (receptor of High value). In the long term the magnitude of impacts would be Negligible Adverse and the significance of effects as Neutral or Slight for the River Ebbw saltmarsh (County (Medium) value) and Slight for the River Usk saltmarsh (National (High) value).

Migratory Fish

10.8.102 The noise levels produced within the water column are likely to be low. However, given the uncertainty regarding the pathways by which noise generated on land may transmit through the ground to the water column and the risk that piling may coincide within the key period of sensitivity for migratory fish species (March to June (inclusive)), a precautionary approach has been taken to this assessment.

10.8.103 The installation of piles for the east and west pylon cofferdams, the east and west pylons themselves and for the west and east approach viaducts has the potential to result in underwater noise and vibration effects on migratory fish species, including potential barrier effects to migration. The sheet piles for the cofferdams would be installed using vibropiling as would the casings for the pylons and viaduct piers, the casings would then be excavated by bored piling.

10.8.104 Effects on lamprey, sea trout and European eel are considered to be limited on the basis that the hearing frequencies for lamprey and European eel are unlikely to overlap with those generated by the proposed piling activities and that studies have not demonstrated evidence that sea trout react to the vibropiling. However, there is the potential for adverse effects from vibropiling and bored piling on twaite shad, allis shad and Atlantic salmon in the absence of mitigation.

10.8.105 The area in the vicinity of the River Usk Crossing currently includes industrial areas and docklands and therefore it can be assumed there is a degree of existing light spill into the River Usk and River Ebbw.

10.8.106 In the unlikely event of a pollution spill occurring, contaminants would be rapidly dispersed on the surface by the tidal/river streams and would be subject to large dilution, such that effects on migratory fish are likely to be limited.

10.8.107 Given the very short term and temporary nature of any effects of particulate matter from the construction works on migratory fish as they transit through the estuaries of the River Usk and River Ebbw, together with the high sediment loads in the rivers and that such suspended matter would likely be rapidly dispersed, effects on migratory fish are likely to be limited.

Assessment of Potential Effects

10.8.108 The magnitude of the impact of construction works on the assemblage of migratory fish (receptor of International (Very high) value) in the absence of mitigation other than that included in the Scheme is assessed as Moderate Adverse and the significance of effects as Large or Very large.

Assessment of Effects with Additional Mitigation

10.8.109 As described in Section 10.5, additional mitigation measures would be implemented to reduce the risk to migratory fish, particularly twaite shad, allis shad and Atlantic salmon. Notably, all piling works for the east pylon of the River Usk Crossing would be undertaken outwith the period of highest sensitivity for underwater noise related impacts on migratory fish in the River Usk (i.e. March to June inclusive). The requirement to include other piles in proximity to the River Usk and River Ebbw (e.g. those for the west pylon and some of the viaduct piles) within the seasonal restriction would be determined following the test pile and associated noise monitoring, in consultation with NRW. All piling installation works would be restricted to daytime working hours (i.e. no night time pile

installations). In total, with mitigation in place, vibropiling at the east and west pylon would occur intermittently over five months between the months of July to October with noise levels generated similar to that associated with a small vessel. Bore piling for the east and west pylon would occur intermittently over the five month period.

10.8.110 The careful design and siting of construction lighting, and additional mitigation to avoid directly illuminating the waters of the River Usk and the River Ebbw, as described in Section 10.5, would reduce the potential for impacts on migratory fish species.

10.8.111 The implementation of the best practice pollution and runoff control measures outlined in Section 10.5 and which would be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), the Outline Ground and Surface Water and Groundwater Management Plan (Annex G to Appendix 3.2), which are part of the Scheme are considered to be sufficient to reduce the risk to migratory fish and no additional mitigation measures are proposed.

10.8.112 Taking into account the additional mitigation measures, the magnitude of the impact of construction works on migratory fish (receptors of International (Very high) value) is assessed as Negligible Adverse and the significance as Slight.

Estuarine Fish Assemblage

10.8.113 The implementation of the best practice pollution control measures outlined in Section 10.5 and the pre-CEMP (Appendix 3.2), and the other measures referred to above, during construction would reduce the likelihood of an accidental spillage of chemicals or substances from construction compounds and activities (including vehicles and equipment operating near to watercourses and the drilling mud plants) occurring and impacting estuarine fish species.

10.8.114 In the unlikely event that a spill occurs, contaminants are likely to be rapidly dispersed on the surface by the tidal/river streams (i.e. short-term) and would be subject to large dilution (i.e. temporary), such that effects on estuarine fish are likely to be limited beyond a localised area.

10.8.115 The area in the vicinity of the River Usk Crossing currently includes industrial areas and docklands and therefore it can be assumed there is a degree of existing light spill into the River Usk and River Ebbw.

10.8.116 Any effects associated with particulate matter entering the River Usk or River Ebbw would be short term and temporary in nature as any such material would be dispersed on the tidal/river stream. Furthermore, background concentrations of suspended sediments in these estuaries are high and therefore the estuarine fish assemblage can be considered to be tolerant of a range of turbidity levels.

Assessment of Potential Effects

10.8.117 The magnitude of the impact of construction works on the estuarine fish assemblage (receptor of National (High) value) in the absence of mitigation (other than those measures included as part of the Scheme design comprising best practice pollution and runoff control measures outlined in Section 10.5 and the Pre-CEMP (Appendix 3.2), and the other measures referred to above) is assessed as Moderate Adverse and the significance as Moderate or Large.

Assessment of Effects with Additional Mitigation

10.8.118 The additional piling mitigation to be implemented during construction, as referred to under migratory fish above, would further limit the potential exposure of estuarine fish to disturbance from underwater noise and vibration associated with the piling for the east pylon of the River Usk Crossing (and other piling if necessary).

10.8.119 Lighting for the River Usk Crossing construction compounds would be installed so as to avoid directly illuminating the waters of the River Usk and the River Ebbw and would reduce the potential for impacts to estuarine fish.

10.8.120 The implementation of the best practice pollution and runoff control measures which are part of the Scheme are considered to be sufficient to reduce the risk to estuarine fish and no additional mitigation measures are proposed.

10.8.121 The magnitude of the impact of construction works on the estuarine fish assemblage (National (High) value) with the additional mitigation in place is assessed as Negligible Adverse and the significance of effects as Slight.

Reens, Ditches, Reedbeds and Ponds

10.8.122 The Reens, ditches, reedbeds and ponds Ecological Unit includes the following VERS.

- Eutrophic standing waters.
- Ponds.
- Reedbeds.
- Aquatic macrophytes.
- Otter.
- Water vole.
- Grass snake.
- Great crested newt and other amphibians.
- Freshwater fish assemblage.
- Freshwater invertebrates.

10.8.123 The overall impacts of the construction of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme. Then the impacts on each of the relevant VERs are assessed.

Potential Hydrological Effects of the Earthworks

10.8.124 Dewatering during ground excavation works could result in alterations to water levels within existing reens and field ditches. The ongoing management of water levels within the Levels would continue to regulate water levels during the construction of the new section of motorway. The various species assemblages (e.g. aquatic macrophytes and invertebrates; water vole) have established as a consequence of this long-term management of water levels and habitats, and tolerate seasonal fluctuations in water levels. However there is the potential that earthworks could result in longer-term depletion of water within the reen and field

ditch system that could have a detrimental effect upon key receptors within the reen and field ditch system.

10.8.125 As described in Chapter 11: Geology and Soils, the majority of the proposed new section of motorway would cross the Gwent Levels which is underlain by Tidal Flat Deposits. These typically comprise soft silty clay, with layers of sand, gravel and peat and represent deposit laid down within the tidal zone, although these areas are now reclaimed through the construction of sea defences. Generally the impermeable nature of the deposits isolates ponds from the (saline) ground water. As a consequence most ponds within the Gwent Levels are fed by surface water. Therefore it is not envisaged that the earthworks would cause significant dewatering of ponds.

10.8.126 Similarly reedbeds within the Gwent Levels are fed by surface water. Therefore it is not envisaged that the earthworks would cause significant dewatering of ponds.

10.8.127 The reedbeds which form part of the Tata Steel water treatment system, and which would be crossed by the new section of motorway, are artificially embanked and it is possible that these areas may be at least partially dewatered during the construction works.

10.8.128 Reens within the Gwent Levels support a wide variety of limnophilic coarse fish (living in lakes, ponds, marshes, pools or other slow moving or still water) including roach, tench, bream and carp, and a large population of European eel. Bullhead is a qualifying feature of other designated sites within the study area including the River Usk. However, this rheophilic species (living in in swiftly-flowing water) is characteristic of well-oxygenated faster flowing watercourses and is therefore not likely to occur within the watercourses of the Gwent levels. There is also the potential for brook lamprey to be present within the reen network as this species may be found in streams, brooks and ditches.

10.8.129 All of the freshwater fish species inhabiting the reens and ditches are characteristic of slow-flowing coarse waters of which the reen network is typical, and are often exposed to low oxygen levels during the summer months when the water becomes stagnant and choked with vegetation. The Caldicot and Wentlooge Levels Water Management Plan (Caldicot & Wentlooge Levels IDB, undated) provides on-going management strategies on a seven year cycle to maintain the watercourses for drainage and flood defence. Reens are also maintained in this fashion, with water levels controlled on a seasonal cycle by a system of sluice gates. Controlled water levels are divided into Winter Penning Levels and Summer Penning Levels with lower levels in the winter providing additional storage capacity, and higher levels in the summer providing an agricultural water source. As such the water levels within the reen and ditch network are maintained and controlled in a manner suitable for the fish species found there, and this management would continue throughout the construction of the new section of motorway.

10.8.130 Earthworks, including the infilling of reens and ditches for land take, and temporary diversion of reens during the installation of culverts, have the potential to cause changes in water levels due to hydrological effects and result in potential runoff from construction areas. A number of reens are would be culverted to allow the construction of the new section of motorway. As described in the Buildability Report (Appendix 3.1) the majority of culverts would be

constructed off-line before reconnection with the reen network. The invert level would be a minimum of 150 mm below existing bed level, thus allowing the development of naturalised substrate within the culverts. In addition, hydraulic modelling would inform the maintenance of flow continuity along the reens and ditches and enable capacity for a 1 in 100 year storm event and effectively mitigate for adverse effects on flow regimes.

10.8.131 As explained in the Buildability Report (Appendix 3.1) at the commencement of the construction programme, temporary piped culverts would be installed within the existing reens and ditches to maintain connectivity as the works progress. The permanent culvert installation would take place as the haul road is constructed through the route. The culverts across the Levels would be installed with piled foundations on a half and half basis, constructing one half, switching the haul road through the site and subsequently constructing the other half. Installing the culverts with piled foundations eliminates the need for a consolidation period of the earthworks embankment in soft ground and reduces the need for working within the reen network.

10.8.132 Driven piles may be used for box culverts up to 4.2 m by 4.2 m and bored piles for larger culverts deemed to be bridges. Sheet piles may be needed to support the sides of excavations duing the installation of the culverts. During culvert construction there would be minimal interruption to flow and water levels within the reen network.

10.8.133 Coarse fish are adapted to thrive in still or slow-flowing waters and as such they are able to tolerate stagnant and often eutrophic waters. Eels are particularly tolerant of low oxygen conditions and are able to cross damp ground to reach new waterbodies (Fitter and Manuel, 1991).

10.8.134 Water levels within the reen network would be monitored, and would continue to be controlled by NRW during the construction period, and the potential hydrological effects of earthworks are not considered likely to have significant effects on water levels. Therefore, given the mitigation built into the Scheme, populations of coarse fish within the reens and field ditches are not likely to be at risk from direct harm, effects on spawning or drops in water level.

10.8.135 The diverse invertebrate community typical of the Gwent Levels is characteristic of still slow-flowing water found in the reens and field ditches, with the water beetle assemblage in particular reflecting this character. In addition, the community of Odonata (dragonflies and damselflies) and molluscs including snails and freshwater mussels is also characteristic of this habitat.

10.8.136 Although many aquatic invertebrates are highly sensitive to changes in water levels, flow rates and resulting fluctuations in oxygen and nutrient levels (Extence *et al.*, 1999), the invertebrate assemblage within the Gwent Levels has developed alongside artificial management of water levels in the main reens), including seasonally instigated fluctuations in water levels through the use of sluice gates. The field ditches are maintained by landowners/tenants and have a base level above that of the adjoining reens. As such these ditches often do not hold water all year round, but are an integral part of the reen system and habitats of the Gwent Levels. Therefore, the invertebrates found within the reens and ditches are tolerant of such changes in water levels and flow rates.

Temporary Habitat Loss

10.8.137 To the extent that there may be some loss of reens and ditches during construction, this is included under land take in Section 10.7. The reens and ditches support the important aquatic vegetation and aquatic invertebrate assemblage which are features of the Gwent Levels SSSIs. Field ditches provide connectivity between reens but are frequently dry; however, these do provide valuable corridors for aquatic species during times when they hold water.

10.8.138 There would be no loss of ponds during construction over and above that which would occur as a result of the land take assessed in Section 10.7.

10.8.139 In addition to the 3.19 ha of reedbed affected by the permanent land take for the new section of motorway, a further 3.35 ha at the south of the Tata lagoon area would be affected during construction. As shown on the EMP (Figure 2.6) this area would be returned to reedbed on completion of the new section of motorway.

10.8.140 Construction of the new section of motorway would potentially result in temporary habitat loss through land take for temporary construction use including haul roads, borrow areas, batching plants, soil storage areas and construction compounds. Construction activities would include the creation of new reen bridges and culvert crossings as described below, which would cause temporary disturbance to watercourses (reens and associated field ditches) during construction. New reen culvert crossings would help to maintain freshwater habitat volume and connectivity in the long-term; however this would necessitate short-term impacts to freshwater habitats during construction.

10.8.141 Impacts and effects on the aquatic invertebrate assemblage during the construction phase potentially include: direct loss through habitat disturbance or infilling during construction activities (including culverting); temporary or permanent displacement due to habitat loss or disturbance and associated changes resulting in unfavourable habitat conditions; loss of food sources such as aquatic macrophytes and associated fauna; siltation, pollution and resulting in adverse impacts upon water quality during the construction phase; and fragmentation of populations due to infilling, culverting and intervening habitat alteration.

10.8.142 Notably, temporary construction land would be required at Coedkernew; to the east of Tatton Farm, including reedbeds; to the south of the Tata steelworks including and sludge lagoons and reedbed at Green Moor; and various soil storage and construction areas at the western and eastern ends of the proposed works.

Potential Effects of Discharges of Water from Borrow Pits

10.8.143 Borrow pits for the new section of motorway are proposed to the north east of the existing M4 Junction 29; at Berryhill Farm to the west of Coedkernew; and in the Magor area (both west and east).

10.8.144 Groundwater dewatering of borrow pits during excavation has the potential to generate potentially contaminated groundwater that may be discharged into surface water features, and released into the main reens and field ditches within the Gwent Levels SSSIs. Contaminants and sediments within these waters could result in detrimental effects on reens and field ditches.

10.8.145 The principles of construction phase water management are set out in Annex A.8 of the Buildability Report (Appendix 3.1).

Temporary Severance/Fragmentation of Reens and Field Ditches

10.8.146 Temporary severance and fragmentation of habitats has the potential to result in significant effects upon the integrity and connectivity of aquatic habitats. Temporary severance and/or fragmentation of aquatic habitats would occur during construction through the creation of access routes (which would involve the construction of temporary pipe culverts), construction compounds and other land take, and the construction of the motorway corridor itself, including the construction of culverts to route reens and ditches beneath the new section of motorway. Areas of temporary land take for construction compounds, storage and other areas would be laid out so as to minimise disruption to the existing reen network.

10.8.147 The primary cause of reen and field ditch fragmentation would be the creation of culverts to route reens and field ditches beneath the motorway corridor. Mitigation built into the design would ensure the severance of watercourses during culvert construction would be as brief as possible. As explained in the Buildability Report (Appendix 3.1) the majority of culverts would be constructed off-line from the reen network (with temporary pipe crossings providing for haul-road access until the culvert is completed) and reconnected by diverting through the completed culvert, thus rapidly re-establishing habitat connectivity. Each culvert would be reconnected to the network following its completion. While the culvert itself would take time to establish as a habitat in terms of substrate depth and composition, functional connectivity would be maintained.

10.8.148 Connectivity along watercourses is important to all aquatic organisms and this is particularly important for highly mobile fauna such as fish. Fish rely on a variety of habitat types for foraging, shelter and spawning, and the ability to move between these habitats is critical in the short and long term. Connectivity is particularly important for migratory fish such as the European eel, which return from the sea to freshwater habitats as elvers where they mature before returning to the sea to breed. Eel have the advantage of being able to cross damp land to locate new waterbodies.

10.8.149 Wider fragmentation of intervening habitats between watercourses would likely occur through the creation of construction compounds, soil stockpiles and earthworks including the creation of water treatment and attenuation areas. Such works would be likely to result in the creation of expansive areas of disturbed or bare earth, potentially for the duration of the construction phase (approximately 4 years; see Chapter 3: Scheme Construction). These unvegetated areas would be unsuitable for aquatic invertebrates such as Odonata (dragonflies and damselflies) and other flying insects with larval or adult aquatic stages of their life cycle, which require riparian and terrestrial vegetation for commuting and foraging. Odonata emerge from their aquatic larval stage as flying adults, and patrol vegetation foraging for their prey of smaller insects. Therefore the presence of riparian, marginal and wider vegetation is of vital importance for adult Odonata, especially during the peak emergence season of May to August; both for foraging and commuting between aquatic habitats.

10.8.150 Water beetles are much less dependent upon flight for their life cycle, and will remain within the aquatic environment unless conditions become unsuitable for

them, for example by desiccation or deterioration in water quality. However, many beetles may leave the water for long periods especially during the summer months (Fitter and Manuel, 1994). Therefore, terrestrial vegetation provides important shelter during the terrestrial phase of these beetles.

10.8.151 The extent of land take during the construction phase is significant, but would largely be located outside the Gwent Levels SSSIs and the principal habitats which are important to aquatic invertebrates.

Potential Effects of Pollution from Inappropriate Storage of Chemicals or Spillages

10.8.152 There is potential for pollution events or diffuse pollution to occur during construction as a result of the following.

- Reen / field ditch works/construction compounds including the operation of bentonite plant/polymer plants to support pile installation.
- Earthworks near to reens, ditches or ponds.
- Use of vehicles and machines near watercourses or ponds.
- Spoil / storage heaps near watercourses or ponds.
- Storage and use of chemicals, oil, concrete and cement in or near watercourses or ponds.
- Disposal of water from construction activities.
- Accidental spillages or leakages.

10.8.153 Pollutants may include diesel oil, leachates from cements and/or grouts used in construction, synthetic chemicals and bentonite muds used in pile boring. However, given the mitigation included within the Scheme and described in the pre CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), the Outline Ground and Surface Water and Groundwater Management Plan (Annex G to Appendix 3.2) the likelihood of accidental release of such contaminants is considered to be low. Adherence to these measures, standard best practice guidance and Environment Agency Pollution Prevention Guidelines would significantly reduce the likelihood of an accidental pollution incident occurring.

10.8.154 Pollution with inorganic chemicals can have significant detrimental effects upon fish populations in rivers for many kilometres downstream of the pollution input. Roach, tench and European eel display similar sensitivities to such pollutants, and are generally more tolerant than species characteristic of faster flowing rivers such as rainbow trout and chub.

10.8.155 The relative tolerance of species characteristic of the reens and field ditches to chemical pollutants such as hydrocarbons, cement additives, detergents and other chemicals that may be used during the construction activities is dependent upon the level and duration of pollutant input; fish are often able to avoid intermittent pollution incidents due to their mobility (Mason, 2002). However, more sustained pollutant inputs are likely to have a greater and more prolonged effect.

10.8.156 European eel is a useful indicator species in relation to pollution; this species may remain relatively sedentary during their development period of up to 20

years in freshwater, and can spend a large proportion of their time in close contact with the sediment, from which they can absorb contaminants (Mason, 2002). This can result in bioaccumulation of pollutants within the eel rather than acute toxicity and resulting mortality; however, significant pollution inputs can result in mass mortality of all fish species.

10.8.157 There is the potential for chemicals to inadvertently enter the reen network, under which scenario the pollution could spread to adjoining watercourses and have a widespread adverse effect.

10.8.158 Throughout construction of the new section of motorway, dedicated construction and storage areas would be used for the storage of chemicals and fuels, where required. In accordance with best practice, these areas would be sited away from main reens and watercourses. Chemicals used during construction activities would be stored according to best practice set out in Environment Agency PPGs, including the storage and use of chemicals near water. This includes best practice to be implemented in the event of a leak or spillage in order to contain the pollution and prevent harm to the environment. Such measures would be detailed in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) and the other measures referred to above.

10.8.159 As described in Chapter 16: Road Drainage and Water Environment, water quality data indicate the routine presence of the metals arsenic, boron, zinc, selenium and nickel and the occasional presence of other metals including cadmium, chromium, copper, lead and mercury in the surface waters of the reen system.

10.8.160 As described in Chapter 16: Road Drainage and the Water Environment, water quality monitoring data for Monks Ditch confirms similar concentrations of copper and zinc as seen in the reens generally. The invertebrate monitoring data however indicates a generally declining trend in water quality in Monks Ditch, which receives water from the reens and ditches of the Gwent Levels, although this is primarily associated with organic nutrient levels.

10.8.161 Of the invertebrate groups recorded in the 2014 surveys (Appendix 10.15), Odonata are the most sensitive to organic pollution with Coleoptera and Hemiptera moderately sensitive to pollution. Molluscs are tolerant of poor water quality. While moderately to highly sensitive invertebrates may be tolerant of organic pollution, they may be much more sensitive to pollution by inorganic chemicals or hydrocarbons (Mason, 2002). The impact of such pollutants such as hydrocarbon fuels, heavy metals, detergents, cement additives and others, upon aquatic invertebrates can be immediate, with recovery time dependent upon surviving population numbers, recruitment and recolonization. Conversely, some invertebrates that are highly sensitive to organic pollution may be tolerant to specific inorganic pollutants, with unusually high abundance in the absence of other invertebrates.

10.8.162 Some pollutants, notably heavy metals, may bind to substrate particles and persist in the sediments for a long period of time, often retaining their toxicity to aquatic invertebrates.

10.8.163 In the absence of mitigation and in the event of a chemical spillage into the watercourses of the SSSIs, the impact upon aquatic invertebrates could be rapid and significant. However, the implementation of best practice measures for the

storage of chemicals would ensure that any spillage is contained, and potential harm to the aquatic environment would be minimised. Construction proposals for the new section of motorway also include the creation of dedicated working compounds and storage areas, which would include facilities for chemical and fuel storage. Such measures would be implemented via the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2).

Potential Effects of Runoff from the Construction Area Resulting in Particulate Pollution of Watercourses

10.8.164 The installation of new culverts within reens and field ditches as part of the initial construction of the haul route would result in direct excavation into reens and field ditches. These works would result in an initial plume of sediment being released into adjacent areas that could have the following detrimental impacts.

- Nutrient release from the plumes of sediment causing plumes of aggressive aquatic macrophytes (e.g. algal bloom or dense duckweed growth) leading to loss of key species.
- Suppression of aquatic macrophyte growth under layers of sediment leading to the general degradation of suitability for a range of species within the reen and field ditch network.

10.8.165 The excavation for the installation of the new culverts would fill with groundwater and surface water runoff. In these cases the infilled water would become sediment laden and it is likely the cavity would require pumping out so that the new box culvert can be installed. Pumping these waters directly into main reens or fields ditches would have a detrimental effect on high sensitivity watercourses.

10.8.166 Construction of new reens and ditches would be offline from the existing watercourses and only linked once the new channels had been completed. When the new channel is allowed to flood this would cause a sediment plume to spread into the main reen. Waters flowing into the new channel would also create sediment plumes that would disperse into adjacent reens and field ditches. The ECoW would monitor the works so as to ensure any temporary mitigation measures were implemented as necessary. This may include use of silt traps or bunds.

10.8.167 The use of plant along the haul route could also lead to gradual runoff of sediments that would be especially notable during severe rainfall events. The sediment loading could result in the gradual increase of nutrient levels within the reens and field ditches leading to the gradual deterioration of the ecosystem within the reen and field ditch network. The principles of construction phase water management are set out in the Buildability Report (Appendix 3.1).

10.8.168 As explained in Chapter 3: Scheme Construction, during construction surface water runoff from the embankments across the Levels would be managed by capture and settlement before being released to the existing reen system. The runoff would be captured in a bunded area located along the corridor of construction between the embankment and the permanent parallel field ditch/replacement reen. The bund would be approximately 1 metre above ground level. The adjacent channel would remain vegetated (i.e. the topsoil would not be stripped) in order to allow the following.

- To protect the underlying organic material.

- To reduce the amount of unsuitable material generated.
- retard the flow of water towards the outfall point. The grass would also act as a filter.
- facilitate the deposition of sediment and the retention of oily residues and organic matter, which would be broken down in the top layer of soil.

10.8.169 Due to the minimal longitudinal falls across the Levels, the bunded areas would act as lateral settlement lagoons. Silt fences and settlement weirs would be installed at reens to prevent runoff from entering the reens prior to settlement. Runoff would migrate to natural low areas within the bunded areas and would be pumped to the nearest water treatment area. It is intended to use the locations of the permanent water treatment areas as temporary lagoons for water management during construction.

10.8.170 The temporary lagoons would be formed by approximately 1 metre high perimeter bunds on top of the existing ground surface. The size and layout of the lagoons would be designed to achieve the required degree of settlement and water quality as well as the capacity to accommodate storm events. A water sampling regime would be implemented to ensure that the settled water achieves the required turbidity parameters and can be discharged into the reen network.

10.8.171 As explained in Chapter 16: Road Drainage and the Water Environment, the management of surface water drainage during construction would comply with best practice as described in CIRIA C648 'Control of water pollution from linear construction projects' (Murnane *et al,* 2006). The drainage control would be achieved, as described above, by use of a site specific, hydraulically isolated construction drainage design comprising lateral bunds would be sized to allow capture and sufficient attenuation of rainfall for a 10 year return storm of two day duration and the temporary storage of this water to achieve adequate settlement of 7 hours prior to controlled discharge to the water environment via reens under consent from NRW. Settlement would take place within the construction water treatment areas specifically designed for this purpose.

10.8.172 Additional mitigation which may be required periodically to achieve this objective includes use of pumps, flocculation devices, filtration media, other specialist treatment equipment or off-site disposal as a worst case contingency.

10.8.173 Prior to discharge, treated surface water would be tested to ensure compliance criteria are met for chemical and physical parameters including pH and total suspended solids which are to be agreed with NRW.

10.8.174 Towards the end of construction, the temporary lagoons would be cleaned out of sediments and the permanent WTAs would be constructed.

10.8.175 Coarse fish species, including European eel, present within the reen network, are adapted to the conditions maintained by the on-going management of the system.

10.8.176 The preference of these fish species for still or slow-flowing water means that they are tolerant of relatively high levels of siltation and a soft substrate of fine sediment. While roach are able to spawn in a variety of substrates due to their ability to thrive in a wide range of habitat conditions, brook lamprey for example depend upon deposits of soft sediment for egg-laying (Beardsley, 2012), while

carp and tench deposit their eggs on aquatic plants and are dependent on the presence of macrophytes for spawning (Resseguie and Kelsch, 2008).

10.8.177 Due to their slow-flowing nature, the reens and field ditches have a propensity for the accumulation of silt, current levels of which are controlled by on-going management strategies. Construction of the new section of motorway would inevitably result in significant areas of bare earth, with the potential for large quantities of silt, other sediment and associated pollutants to runoff into the reen network. Therefore, in the absence of mitigation, there is the potential for large additional quantities of silt to disrupt the ecological balance of the reen network.

10.8.178 While the freshwater fish community is adapted to survive in the slow-flowing conditions characteristic of the reen network, a significant additional input of fine sediment above and beyond what is currently managed through the on-going maintenance cycle would potentially lead to the following impacts and effects: choking and shading of aquatic vegetation resulting in plant decay and increased eutrophication; reduced oxygen levels due to reduced macrophyte growth and eutrophication; increased turbidity of heavily silted sections creating impassable barriers to fish movement; direct mortality of fish in blind-ending reens and ditches due to siltation and associated pollution inputs; and reduced availability of spawning habitat as described above.

10.8.179 The invertebrate fauna of the reens and ditches has developed in parallel with the management strategy for the Gwent Levels, and is dependent upon the conditions created by regular management to create optimal conditions for the species assemblage found there. Nevertheless, input of large quantities of silt-laden runoff during construction could adversely impact the aquatic invertebrate community within the reens and field ditches.

10.8.180 Excess siltation over a short period of time can harm invertebrates by clogging their gills, reducing the oxygen-carrying capacity of the water, blocking sunlight from macrophytes and leading to eutrophication and subsequent effects on invertebrate assemblages, and affect the flow regime of the channel.

10.8.181 Runoff from the construction site is also likely to contain other pollutants resulting from construction activities, including those described above. These pollutants can be combined with or chemically bound to sediment particles, and therefore be carried into the watercourse in the event of heavy rainfall. Suspended sediment particles, in particular fine particles of less than 63 µm diameter, act as a transport medium for metals, polyaromatic hydrocarbons (PAHs) and organic matter (Moy *et al*., 2003). It is also these fine particles that remain suspended in the water column for longest and present the greatest risk of contamination.

Pre-construction Surveys and Training

10.8.182 Taking into account the mobile nature of otters, water voles and great crested newt, mitigation measures would include pre-construction surveys in order to inform the final otter, water vole and great crested newt mitigation Method Statements and any potential European Protected Species otter and great crested newt licence applications.

10.8.183 All ecological mitigation works would be carried out under the guidance and, where necessary, the on-site instruction and watching brief of an appropriately qualified and experienced Ecological Clerk of Works (ECoW). Mitigation measures would be included in site inductions and toolbox talks.

Wildlife Fencing

10.8.184 In order to prevent access to working areas and to guide otters into culverts and mammal crossings, the mitigation strategy would include the pre-construction installation of mammal exclusion fencing suitable for otters and badgers around the boundary of the works site (including temporary working areas, but excluding access routes) and up to the entrances to culverts, dry underpasses and mammal crossings, in accordance with guidelines published in DMRB Volume 10, Section 4, Part 2 (Highways Agency, 2001) and Part 4 (Highways Agency, 1999).

10.8.185 Fencing would be installed under the supervision of an appropriately experienced person so as to ensure there would be no gaps along the fence line that otters could push through, e.g. where the fencing abuts features such as hedges, stiles or fences.

Construction Lighting

10.8.186 Disturbance from external light sources can stimulate patterns of movement in non-migratory freshwater fish (coarse fish) (Lucas *et al.*, 1998). Light may influence the success of predatory fish and the movement of largely nocturnal species, with fish moving to darker areas as a predator avoidance mechanism. As such, artificial nocturnal lighting can present a disturbance to normal fish behaviour if direct lighting or light spillage onto a watercourse occurs.

10.8.187 Migratory fish, such as eel, are thought to be tolerant of artificial light, with young eel having been shown to exhibit little difference in migratory tendencies between light and dark (Lucas *et al*., 1998). However, mature eels are more active at night and are therefore more susceptible to disturbance from artificial light. Less is known about the effects of artificial light on brook lamprey, but anadromous river and sea lamprey are known to avoid light during their migration (Lucas *et al*., 1998).

10.8.188 Artificial light close to waterbodies may have adverse effects upon invertebrates that are sensitive to daylight rhythms and seasonal changes for breeding cycles in particular. Some invertebrates also respond by moving away from light sources as part of nocturnal predator-avoidance strategies, and may therefore be prone to disturbance from artificial lighting. Artificial light and reflected polarised light from shiny surfaces can disrupt the behaviour of aquatic invertebrates, notably by attracting egg-laying females away from water (Bruce-White and Shardlow, 2011). In addition, the presence of artificial and polarised light sources near waterbodies has been found to attract aquatic beetles, and this may contribute to further declines in the populations of rare water beetles, some of which are components of the invertebrate assemblage in the Gwent Levels.

10.8.189 The potential for light disturbance to disrupt breeding cycles and potentially affect breeding success and population recruitment is currently not fully understood (Bruce-White and Shardlow, 2011). Therefore, whilst the impact of artificial lighting upon aquatic invertebrates would be minimal, given the significance of the invertebrate assemblage in a Welsh context and the presence of rare species of water beetles that may be prone to disturbance from artificial light sources, a precautionary approach has been adopted.

10.8.190 As explained in Section 10.5 referring to Chapter 3: Scheme Construction, the normal working hours would be 07.00 to 19.00 hours (Monday to Friday), and 07.00 to 17.00 hours on Saturdays. The majority of construction activities would be undertaken within this period. 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 during the night time. Such task lighting would be positioned at low level on posts and directed at the most frequently used areas of work.

10.8.191 Inward facing security lighting would be provided at construction compounds on a 24 hour basis.

10.8.192 As explained in Chapter 3: Scheme Construction, a more detailed lighting strategy for the construction period would be developed to identify the type of lighting to be used and measures to be implemented to reduce light spill. The strategy would be agreed with the local planning authority and the regulator.

Noise

10.8.193 As explained in Chapter 13: Noise and Vibration, earthworks has been identified as the most noisy activity, with driven piling also a significant noise source. The installation of pre-cast driven piles would be required along the route of the new section of motorway where a higher embankment is needed to take the proposed carriageway over existing side roads and the mainline railway. Driven piles may also be required to support new culverts. Given the close proximity of the works to watercourses in the reen network, disturbance to freshwater fish species (including some of the same migratory species that use both the rivers and reen network) is possible.

10.8.194 Anthropogenic noise is known to cause disturbance to fish although most studies have concentrated on extreme noises from sources such as pile driving or seismic air guns (Popper and Hastings, 2009). Noise generating activities would be an integral part of construction activities and would therefore be unavoidable. Given the route of the new section of motorway and the crossing of numerous reens and ditches, noise disturbance to fish species within these watercourses during the construction period is likely.

10.8.195 Throughout the construction phase it is proposed to maintain the connectivity of reens and ditches within the network where possible as described above. Therefore it would be possible for fish to utilise the longitudinal connectivity and the reen/ditch network to escape disturbance and seek refuge in areas where no construction activities are occurring at that time. Not all of the reen network would be disturbed by construction activities at any one time i.e. the actual impacts to any one area of the reen network would be limited to months rather than years. Fish have the advantage of being highly mobile and given the extensive network of reens and ditches it is envisaged that there is likely to remain sufficient connectivity and undisturbed areas of the reen network for them to escape this disturbance.

Eutrophic Standing Waters

Assessment of Potential Effects

10.8.196 The magnitude of the impact of construction works on eutrophic standing waters (receptor of National (High) value) taking account of the pollution control and other water management measures included in the Scheme and described in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2) and the Outline Ground and Surface Water Management Plan (Annex G to Appendix 3.2) is assessed as Minor Adverse and the significance of effects as Slight or Moderate.

Assessment of Effects with Additional Mitigation

10.8.197 No additional mitigation is proposed and so the magnitude of the impact on eutrophic standing waters (receptor of National (High value) following the implementation of mitigation would remain as Minor Adverse and the significance of effects as Slight or Moderate.

Ponds

Assessment of Potential Effects

10.8.198 The magnitude of the impact of construction on ponds (receptor of County (Medium) value) taking into account the pollution control and other water management measures included in the Scheme and described in the Pre-CEMP (Appendix 3.2), and the other measures referred to above, is assessed as Minor Adverse and the significance of effects as Slight.

Assessment of Effects with Additional Mitigation

10.8.199 No additional mitigation is proposed and so the magnitude of the impact on ponds (receptor of County (Medium) value) would remain as Minor Adverse and the significance of effects as Slight.

Reedbeds

10.8.200 In addition to the 3.19 ha of reedbed affected by the permanent land take for the Scheme, a further 3.35 ha at the south of the Tata lagoon area would be affected during construction. As shown on the EMP (Figure 2.6) this area would be returned to reedbed on completion of the Scheme.

Assessment of Potential Effects

10.8.201 The magnitude of the impact of the construction works on reedbeds (receptor of County (Medium) value), taking into account that the reedbed affected during the construction period would be restored on completion, is assessed as Moderate Adverse and the significance as Moderate in the medium term. In the long term as the new reedbeds established the magnitude would be Negligible and the significance Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.8.202 No additional mitigation is proposed, thus the magnitude of impacts from construction on reedbeds remains as Moderate Adverse and the significance of

effects as Moderate in the medium term. In the long term, as the new reedbeds established, the magnitude of impacts would be Negligible Adverse and the significance of effects Neutral or Slight.

Aquatic Macrophytes

Assessment of Potential Effects

10.8.203 The magnitude of the impact of the construction works on aquatic macrophyte assemblages (receptor of National (High) value) in the absence of mitigation, other than the pollution control measures which would be implemented as part of the Scheme, and which are described in the Pre-CEMP (Appendix 3.2), and the other measures referred to above, is assessed as Moderate Adverse and the significance of effects as Moderate or Large.

Assessment of Effects with Additional Mitigation

10.8.204 Additional measures would be implemented to ensure that there were no more than short duration changes in reen and ditch water levels during construction through, for example, installation of temporary stop-boards and over-pumping as required.

10.8.205 The magnitude of the impact of the construction works on aquatic macrophyte assemblages (receptor of National (High) value) following the implementation of mitigation is assessed as Minor Adverse and the significance of effects as Slight or Moderate.

Otter

10.8.206 The results of the 2014 and 2015 otter survey (Appendices 10.8 and 10.25), indicates that the construction working corridor would cross ten watercourses where signs of otter activity have been recorded, including the River Usk and River Ebbw; two reens (Percoed Reen, Coedkernew, and Middle Road Reen on the Tata Steel site); two main drains on the Tata Steel site (including Monk's Ditch); and one stream (to the north of the existing M4 and Magor). In addition, the works area would be located adjacent to two watercourses where otter activity has been recorded; Nant y Moor Reen, to the south of Imperial Park and east of Coedkernew, and a ditch to the south of Rush Wall track to the south of Llandevenny and the A4810.

10.8.207 Reens crossed by the construction corridor would be retained and culverted as part of Scheme, as described in Section 10.5, which would help to minimise the impact of construction on otter movement during construction, which could otherwise result in fragmentation of the local otter population and in turn affect breeding success, as well as affect an otter's ability to access feeding and resting sites.

10.8.208 In addition, as described in Section 10.3, mitigation would include the construction of dry mammal crossings at locations along the new section of motorway as shown on the EMP (Figure 2.6).

10.8.209 The locations of culverts, dry underpasses and mammal crossings have been selected to be of maximum benefit to protected species including otter. The construction of culverts and installation of mammal fencing would be undertaken during the first eight months of the works on the Caldicot Levels and the first nine

months on the Wentlooge Levels (Appendix 3.1 Buildability Report). Mammal crossings would be constructed as soon as practicable during construction of the road formation.

Potential for Injury or Fatality

10.8.210 During construction of the new section of motorway, the following measures would be set in place so as to minimise the potential for injuries or fatalities to otters.

10.8.211 Mammal exclusion fencing would be inspected throughout construction so as to ensure any necessary repairs are undertaken as soon as practicable.

10.8.212 Any excavations that are located outside the mammal exclusion fencing that are more than 0.5 m deep would be fenced individually; covered overnight where practicable; walls would be re-profiled so as to enable otters to walk out of the excavation; or a means of escape would be provided, such as a wooden plank rested against the wall of an excavation that could act as a ladder.

10.8.213 An emergency procedure in the event of encountering an otter or potential otter rest/holt would be given to contractors. An appropriately qualified and experienced ecologist (who could be the ECoW) would attend the site as soon as practicable in order to confirm reports of otter activity, and to assess the need for further surveys to confirm the presence of otter holts/resting places and/or the need for a development licence for otters to enable works to recommence.

10.8.214 If an NRW licence for otters is required for works to continue, works within a defined area around the holt/resting place would be halted until a licence had been granted. Once a licence has been obtained, works in the area would then be completed in accordance with the requirements of the licence.

10.8.215 If a dead or injured otter is located, the ECoW or appropriately experienced ecologist instructed by the ECoW would determine the cause of death where possible (e.g. through speaking to site workers, inspecting the body and/or investigating site conditions). If the death is considered likely to be a result of construction works, the ecologist would assess the need for further mitigation. A report of the findings of the site visit and implications for construction would be produced by the ECoW and provided to the Developer and Site Manager as soon as practicable and to NRW as required/requested.

10.8.216 The ECoW would monitor the effectiveness of any new mitigation measures so as to ensure any amendments or additional measures are set in place as soon as practicable.

Assessment of Potential Effects

10.8.217 Taking into account the measures to limit the potential for and likely impact of pollutants (runoff and light spill), the commitment to culvert retained reens, and the planting and creation of replacement and new habitats of value to otters (including woodland, scrub, hedgerows and reedbeds) as shown on the EMP (Figure 2.6), the likely magnitude of impact of construction on otters (of National (High) value) is assessed as Moderate Adverse and the significance of effect as Moderate or Large, largely due to the absence of mammal exclusion fencing around working areas, lack of mammal crossings and the potential risk to otters

of culverts designed without measures to ensure safe dry passage at times of flood.

Assessment of Effects with Additional Mitigation

10.8.218 Taking into account additional the additional mitigation measures described above, the installation of mammal exclusion fencing around boundaries of the work sites; provision of mammal crossings and dry tunnels adjacent to all reen culverts, the magnitude of the likely impact on otters (National (High) value) of construction is assessed as Minor Adverse and the significance of effect as Slight or Moderate.

Water Vole

10.8.219 Construction could result in water vole injuries and/or fatalities as watercourses inhabited by water voles are culverted or in-filled, and as a result of compaction of soils adjacent to and disturbance to watercourses inhabited by water voles during construction.

10.8.220 Therefore, measures would be implemented during construction to displace or translocate water voles from working areas to favourable receptor sites prior to the commencement of construction in accordance with a water vole Method Statement. The exact area of displacement or clearance at any location would be determined with regard to habitats and the type of land use and would be agreed with NRW.

10.8.221 Measures included in the water vole Method Statement may include: habitat management (e.g. clearance of scrub and mowing of grass cover) in order to remove bankside ground cover and thereby help to displace and/or deter water voles throughout the construction phase in an area; the excavation and in-filling of burrows under an ecological watching brief; the drainage of watercourse prior to infilling in order to deter water voles; the installation of steel mesh across excavated banks and/or the banks and channels of newly constructed watercourses in order to prevent water voles from (re-)excavating burrows; and the capture and translocation of individuals to pre-prepared receptor sites.

10.8.222 If required, the receptor sites would be agreed with NRW. Where necessary, habitat creation and/or enhancement measures would be undertaken prior to any displacement or translocation in order to ensure receptor sites are in favourable condition prior to translocation. Measures could include clearance of bankside scrub and mowing to encourage the development of good ground cover. Should a receptor site be located outside the existing area covered by the Gwent Wildlife Trust mink control programme, a mink control management plan would be instated prior to translocation in order to help ensure any displacement or translocation is successful.

10.8.223 Where practicable and appropriate, receptor sites would be located as close as practicable to the works area. Receptor sites may be located within the SSSI Mitigation Areas or other suitable locations with agreement.

10.8.224 The translocation would be undertaken by appropriately experienced and qualified ecologists, working under the guidance of the ECoW.

10.8.225 Reports of all captures and translocations would be maintained by the ECoW and would be provided on a regular basis to the Project Manager and NRW.

Assessment of Potential Effects

10.8.226 Taking into account the measures to be implemented during construction which are part of the Scheme, in particular measures which would be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) to limit the potential for and likely impact of pollutant runoff and light spill) and the culverting of reens, the likely magnitude of the impact of construction on water voles (of County (Medium) value) is assessed as Major Adverse and the significance of effects as Moderate or Large Adverse, primarily due to the likely impact of in-filling of watercourses inhabited by water voles along the route.

Assessment of Effects with Additional Mitigation

10.8.227 Taking into account additional construction mitigation measures, primarily measures to deter or translocate water voles from working areas and a surrounding buffer zone which would be undertaken in accordance with an NRW approved Method Statement; and the construction of culverts with adjacent mammal tunnels of 900 mm diameter, and other dry mammal crossings, the likely magnitude of the impact on water voles of construction with the additional mitigation is assessed as Minor Adverse and the significance of effects as Slight Adverse.

Grass Snake

Pre-construction Displacement of Grass Snakes

10.8.228 Without appropriate mitigation, construction could result in direct injuries and/or fatalities to grass snakes. Therefore, mitigation measures designed to displace grass snakes from working areas prior to the commencement of construction would be implemented during construction.

10.8.229 Mitigation measures would be set out in an approved grass snake Method Statement. Measures may include habitat management (e.g. clearance of scrub and mowing of grass cover) in order to remove ground cover along the banks of watercourses/waterbodies within the working area to displace grass snakes, and identification of features of potential importance to grass snakes, such as leaf piles, and where these would be affected by the Scheme, removal to suitable locations at the boundary of the new section of motorway or elsewhere by agreement.

Assessment of Potential Effects

10.8.230 Taking into account measures included as part of the Scheme, in particular measures to limit the potential for and likely impact of pollutants (runoff and light spill) and the commitment to retaining and culverting reens, the likely magnitude of the impact of construction without mitigation on grass snake (of County (Medium) value) is assessed as Major Adverse and the significance of effects as Moderate or Large Adverse primarily due to the likely impact of in-filling of watercourses and destruction of vegetation and habitat features of value to grass snakes.

Assessment of Effects with Additional Mitigation

10.8.231 Taking into account additional mitigation measures, primarily measures to displace grass snakes from working areas, and pre-construction surveys and translocation of habitat features of value to grass snakes, the likely magnitude of the impact of construction with additional mitigation on grass snake is assessed as Minor Adverse and the significance of effects as Slight Adverse.

Great Crested Newt and Other Amphibians

Pre-construction Displacement and/or Translocation of Great Crested Newts

10.8.232 Great crested newts typically disperse up to 250 m from their breeding sites (English Nature, 2001), although they can travel further, and have been known to travel further than 1 km. Therefore, although results of the 2015 great crested newts eDNA survey (Appendix 10.22) indicate that the Scheme would not result in the loss of any watercourses where great crested newt DNA was recorded, newts could move into working areas during the construction phase. Newts could also begin to utilise watercourses where they have previously been recorded as absent, prior to or during the construction phase.

10.8.233 Construction could result in great crested newt injuries and/or fatalities (e.g. if newts were to enter working areas). Therefore, construction works in areas where great crested newts are likely to be present would be undertaken in accordance with a great crested newt European Protected Species licence and associated Method Statement.

10.8.234 As explained in Section 10.5, mitigation measures that would form part of any great crested newt licence application, and would be undertaken at an appropriate time of year and during appropriate local weather conditions, would include:

- the installation of great crested newt exclusion fencing around working areas within 250 m of habitat known to or likely to be inhabited by great crested newts, in order to prevent great crested newts from entering, but to enable them to leave, the construction site;
- if required pre-construction trapping in order to capture and translocate any great crested newts from within exclusion fenced areas to appropriate receptor sites outside working areas, for example in the SSSI mitigation areas (Appendix 10.35) or elsewhere by agreement;
- the clearance of habitat of potential value to newts from within exclusion fencing in order to capture any remaining newts and translocate them to the approved receptor sites; and
- the installation of culverts.

10.8.235 Where necessary, habitat creation and/or enhancement measures would be undertaken in order to ensure receptor sites are in favourable condition prior to displacement or translocation. Measures could include clearance of overhanging and over-shading scrub along the banks of watercourses/waterbodies in order to encourage the establishment and spread of aquatic vegetation, and provision of hibernacula, potentially using suitable materials derived from site clearance. These measures would also be beneficial for the other amphibians recorded in the area.

10.8.236 If required the translocation of great crested newts would be undertaken by appropriately experienced and qualified ecologists, working under the guidance of the ECoW. Other amphibians which may be captured would also be moved to safe locations. Reports of all captures and translocations would be maintained by the ECoW and would be provided on a regular basis to the Project Manager and NRW.

Assessment of Potential Effects

10.8.237 Taking into account measures to limit the potential for and likely impact of pollutants which would be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2), and the commitment to replacing and culverting reens, the likely magnitude of the impact of construction without mitigation on great crested newts (of County (Medium) value) is assessed as Major Adverse and the significance of effects as Moderate or Large, largely due to the potential for injuries and fatalities without exclusion fencing and a capture and translocation exercise.

10.8.238 The magnitude of impacts of construction on other amphibians (District (Low) value) would be Major Adverse and the significance of effects Slight or Moderate.

Assessment of Effects with Additional Mitigation

10.8.239 Taking into account additional mitigation measures, primarily the use of amphibian exclusion fencing; the pre-construction capture and translocation of newts from working areas, which would be undertaken in accordance with a European Protected Species licence and Method Statement, the likely magnitude of the impact of construction on great crested newts with this construction mitigation is assessed as Minor Adverse and the significance of effects as Slight Adverse.

10.8.240 The magnitude of impacts on other amphibians, acknowledging that any translocation would not specifically target these species, is assessed as Moderate Adverse leading to effects of Slight significance.

Freshwater Fish Assemblage

Assessment of Potential Effects

10.8.241 The measures to be implemented during construction which are part of the Scheme, in particular measures which would be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) to protect water quality are considered to be sufficient to reduce the risk to freshwater fish from pollution. The magnitude of the impact of the construction works on freshwater fish (receptor of County (Medium) value) in the absence of mitigation (other than those measures included as part of the Scheme design) is assessed as Minor Adverse and the significance of effects as Slight due to the impact of temporary severance/fragmentation of habitat.

10.8.242 For European eel (International (Very high) value) in the absence of mitigation (other than measures included in the Scheme) the magnitude of the impact of construction is assessed as Minor Adverse and the significance of effects Moderate or Large due to the impact of potential temporary severance/fragmentation of habitat.

Assessment of Effects with Additional Mitigation

10.8.243 The magnitude of the impact of construction on freshwater fish (receptor of County (Medium) value) taking into account the additional mitigation to manage water levels in reens and ditches during construction is assessed as Negligible Adverse and the significance of effects as Neutral or Slight.

10.8.244 The magnitude of the impact of construction on European eel (receptor of International (Very high) value) taking into account the additional mitigation to manage water levels in reens and ditches during construction is assessed as Negligible Adverse and the significance of effects as Slight.

Freshwater Invertebrates

Assessment of Potential Effects

10.8.245 The mitigation measures that would be implemented to protect water quality which would be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2) would reduce the risk to aquatic invertebrates from pollution. The magnitude of the impact of the construction works on freshwater aquatic invertebrates (receptor of National (High) value) in the absence of mitigation (other than those measures included as part of the Scheme design) is assessed as Moderate Adverse and the significance of effects as Moderate or Large.

Assessment of Effects with Additional Mitigation

10.8.246 The magnitude of the impact of the construction works on aquatic invertebrates (receptor of National (High) value) with the proposed additional mitigation measures to manage water levels during construction is assessed as Minor Adverse and the significance of effects as Slight or Moderate.

Grazing Marsh

10.8.247 The Grazing marsh Ecological Unit includes the following VERS.

- Coastal and floodplain grazing marsh.
- Shrill carder bee.
- Wet grassland plants.

10.8.248 The overall impacts of construction of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme and then the additional mitigation proposed. Then the impacts on each of the relevant VERs is assessed.

Temporary Habitat Loss

10.8.249 The extent of the temporary land take for construction purposes is shown on Figure 2.16. As explained in Section 10.7, in addition to the permanent land take for the Scheme, an additional 8.85 ha of grazing marsh would be required for temporary use for construction purposes. This has been included in the total land take figure for grazing marsh of 86.4 ha for the purposes of the assessment of habitat loss due to land take as it is assumed that vegetation would be lost from these construction areas for the duration of the works.

10.8.250 The land take for construction though the Gwent Levels SSSIs has been kept to a minimum and the areas required for construction generally comprise narrow strips along the edge of the Scheme through these sections. There is a more extensive area from chainage 6100 to chainage 6700 for construction of the bridge over the South Wales to London Mainline railway line. Once these areas are no longer required they would be restored to grassland and handed back to the landowner.

10.8.251 Since the habitat loss has already been included in the assessment of land take impacts, no separate assessment is necessary here.

Potential Hydrological Effects of the Earthworks

10.8.252 The soil moisture regime in the grazing marsh habitat is currently controlled by the penning levels in the reens, which are managed by NRW, and rainfall. This regime would continue during the construction period.

10.8.253 As explained in Chapter 3: Scheme Construction, the key stages of constructing reen crossings would be as follows.

- Temporary pipes would be installed within the existing reens and ditches early in the construction programme to maintain connectivity of the watercourses and to provide temporary plant crossings. The number of pipes installed would vary according to the reen channel dimensions and the discharge rate.
- The permanent box culverts would be installed with piled foundations. In areas where precast driven piles are used, the permanent box culvert would be installed after the piling is installed.
- The permanent culvert installation would take place once the haul road is constructed. The culverts would be constructed on a half and half basis (i.e. constructing half of the culvert, switching the haul road to the other side of the carriageway then construct the other half of the culvert) to maintain the haul route access through the site.

10.8.254 There would thus be little disruption to reen connections whilst new culverts were installed, and once the new culverts were in place the reen connections across the line of the road would be fully re-established.

Temporary Severance/Fragmentation of Habitats or Corridors

10.8.255 As explained in Section 10.6, the land take for construction through the Gwent Levels SSSIs has been kept to a minimum and the areas required for construction generally comprise narrow strips along the edge of the Scheme through these sections. There would thus be no significant habitat severance as a result of construction beyond that which would be caused by the completed operational Scheme which is assessed in Section 10.9.

Potential Effects of Pollution from Inappropriate Storage of Chemicals or Spillages

10.8.256 There is a risk that pollution may accidentally be released from the construction areas and result in contamination of the grazing marsh habitat. This could arise from the following.

- Works/construction compounds including the operation of bentonite plant/polymer plants to support pile installation.
- Earthworks.
- Use of vehicles and machines.
- Runoff from spoil/storage heaps.
- Storage and use of chemicals, oil, concrete and cement.
- Disposal of water from construction activities.
- Accidental spillages or leakages.

10.8.257 Pollution may include diesel oil, leachates from cements and/or grouts used in construction, synthetic chemicals and bentonite muds used in pile boring.

10.8.258 As explained in Chapter 3: Scheme Construction, fuel would not be stored in compounds within the Levels sections of the route. Risks would thus arise from transport and use of materials during the construction works. Appropriate measures for prevention of release of these materials during use are outlined in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), and the Outline Ground and Surface Water Management Plan (Annex G to Appendix 3.2) and would be set out in detail in the CEMP which would be in place before the start of construction. Adherence to these measures, standard best practice guidance and Environment Agency Pollution Prevention Guidelines would significantly reduce the likelihood of an accidental pollution incident occurring.

Potential Effects of Runoff from the Construction Area Affecting Adjoining Land

10.8.259 There is the potential for runoff from the construction areas onto adjoining grazing marsh habitat. This could result in waterlogging of land adjacent to the construction site and potential smothering of vegetation with deposited silt.

10.8.260 The principles of construction phase water management are set out in the Buildability Report (Appendix 3.1).

10.8.261 As explained in Chapter 3: Scheme Construction, during construction surface water runoff from the embankments across the Levels would be managed by capture and settlement before being released to the existing reen system. The runoff would be captured in a bunded area located along the corridor of construction between the embankment and the permanent parallel field ditch/replacement reen. The bund would be approximately 1 metre above ground level. The adjacent channel would remain vegetated (i.e. the topsoil would not be stripped) for the following purposes.

- To protect the underlying organic material.
- To reduce the amount of unsuitable material generated.
- To retard the flow of water towards the outfall point. The grass would also act as a filter.
- To facilitate the deposition of sediment and the retention of oily residues and organic matter, which would be broken down in the top layer of soil and vegetation.

10.8.262 Due to the minimal longitudinal falls across the Levels, the bunded areas would act as lateral settlement lagoons. Silt fences and settlement weirs would be installed at reens to prevent runoff from entering the reens prior to settlement. Runoff would migrate to natural low areas within the bunded areas and would be pumped to the nearest water treatment area. It is intended to use the location of the permanent water treatment areas as temporary lagoons for water management during construction.

10.8.263 The temporary lagoons would be formed by approximately 1 metre high perimeter bunds on top of the existing ground surface. The size and layout of the lagoons would be designed to achieve the required degree of settlement and water quality as well as the capacity to accommodate storm events. A water sampling regime would be implemented to ensure that the settled water achieves the required turbidity parameters and can be discharged into the reen network.

10.8.264 Towards the end of construction, the temporary lagoons would be cleaned out of sediments and the permanent WTAs would be constructed.

Coastal and Floodplain Grazing Marsh

Assessment of Potential Effects

10.8.265 Taking into account the measures incorporated into the Scheme described in Chapter 3: Scheme Construction, the magnitude of the impact of the construction works based on the potential for hydrological effects, pollution, and construction runoff during construction on grazing marsh habitat (of National (High) value) is assessed as Negligible Adverse and the significance of effects as Slight.

Assessment of Effects with Additional Mitigation

10.8.266 The mitigation measures incorporated into the Scheme described in Chapter 3 Scheme Construction are considered to be sufficient to manage the risks to grazing marsh during construction and no additional mitigation measures are proposed. Thus the magnitude of the impact remains as Negligible and the significance of effects as Slight.

Shrill Carder Bee

10.8.267 As explained in Section 10.7, the land take for construction though the Gwent Levels SSSIs (shown on Figure 2.16) has been kept to a minimum and there would thus be no significant additional land take in these areas during construction which would affect shrill carder bee.

10.8.268 However, there would be significant additional land take during construction in Newport Docks and within the Tata Steel site at Llanwern in areas where shrill carder bee was found during the 2015 bumblebee survey (Appendix 10.31). As explained in Chapter 3: Scheme Construction, following completion of the works all temporary construction work sites would be removed and the land affected would be restored. In restoring the construction sites within Newport Docks and Tata Steel, the habitat requirements of shrill carder bee (and as explained in Section 10.7 terrestrial invertebrates generally) would be taken into account. In particular, the seed mixes used in restoring these areas would include food plant species of value to shrill carder bee. Similarly the brownfield site at Great Pencarn would also be restored following the same principles.

10.8.269 The additional habitat loss described above as a result of the construction areas in Newport Docks and the Tata Steel land would be contiguous with the areas for the permanent works and would not result in significant additional habitat severance beyond that resulting from the permanent works (assessed in Section 10.7).

10.8.270 Shrill carder bees are active by day and so would not be affected by any lighting of the construction areas.

Assessment of Potential Effects

10.8.271 Taking into account the measures incorporated into the Scheme described in Chapter 3: Scheme Construction the majority of potential impacts resulting from the construction works on shrill carder bee would be of no significance. However the magnitude of the impacts on shrill carder bee (National (High) value) as a result of the additional land take for construction is assessed as Moderate Adverse and the significance of effects as Moderate or Large in the long term.

Assessment of Effects with Additional Mitigation

10.8.272 The magnitude of impacts of the construction works resulting in additional habitat loss for shrill carder bee (National (High) value), taking into account the sympathetic restoration of the construction areas in Newport Docks and Tata Steel on completion of the works, is assessed as Moderate Adverse leading to effects of Moderate or Large significance in the medium term, and Minor Adverse and the significance of effects as Slight or Moderate in the long term.

Wet Grassland Plants

Assessment of Potential Effects

10.8.273 The magnitude of the impacts of the construction works on notable wet grassland plants (County (Medium) value) taking into account the measures to be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), the Outline Ground and Surface Water and Groundwater Management Plan (Annex G to Appendix 3.2) to protect against potential hydrological, pollution, and construction runoff effects during construction is assessed as Negligible Adverse and the significance of effects as Neutral or Slight in the medium term.

Assessment of Effects with Additional Mitigation

10.8.274 The mitigation measures incorporated into the Scheme described in Chapter 3: Scheme Construction are considered to be sufficient to manage the risks to adjoining habitat for notable wet grassland plants during construction and no additional mitigation measures are proposed. Thus the magnitude of the impact would remain as Negligible Adverse and the significance of effects as Neutral or Slight.

Farmland

10.8.275 The Farmland Ecological Unit includes the following VERS.

- Lowland mixed deciduous woodland (including) Wet woodland).

- Hedgerows.
- Lowland meadow.
- Dormouse.
- Badger.
- Hedgehog.

10.8.276 The overall impacts of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme and then the additional mitigation proposed. Then the impacts on each of the relevant VERs is assessed.

Temporary Habitat Loss

10.8.277 As explained in Section 10.7, the total loss of woodland habitat as a result of the land take for the new section of motorway (including that within temporary construction areas) would be 49.8 ha (of which 7.15 ha is semi-natural woodland and 42.6 ha plantation). Of this total 46.0 ha is required for the permanent elements of the Scheme, and 3.81 ha is for temporary construction requirements. Of the 3.81 ha, 1.53 ha is semi-natural woodland and the remaining 2.28 ha is plantations.

10.8.278 Since the areas for temporary construction use are already included in the total land take for the Scheme assessed in Section 10.7, no further assessment is required here. The assessment of impacts without mitigation (other than that which is integral to the Scheme) is as follows.

- Plantation woodland (District (Low) value): Moderate Adverse magnitude of impacts and effects of Slight significance in the medium term, but in the long term as the new plantings mature Negligible Adverse magnitude of impacts and effects of Neutral or Slight Significance and potentially Beneficial.
- Semi-natural woodland (County (Medium) value): Major Adverse magnitude of impacts and effects of Moderate or Large significance in the medium and long term.

10.8.279 The assessment with additional mitigation is as follows.

- Plantation woodland (District (Low) value): Moderate Adverse magnitude of impacts and effects of Slight significance in the medium term, but in the long term Negligible Adverse magnitude of impacts and effects of Neutral or Slight Significance and potentially Beneficial.
- Semi-natural woodland (County (Medium) value): Major Adverse magnitude of impacts and effects of Moderate or Large significance in the medium term, but in the long term Moderate Adverse magnitude of impacts and effects of Moderate significance.

10.8.280 As explained in Section 10.7, the new section of motorway would result in the loss of a total of some 35.8 km of hedgerows of which some 8.2 km are species-rich intact hedgerows. The remaining 27.6 km are species poor and/or defunct hedgerows. Of the 8.2 km of species rich hedgerows, 1.3 km would be within the temporary construction land. Of the 27.6 km of species poor and defunct hedgerows, 4.9 km would be within the temporary construction land.

10.8.281 Since the areas for temporary construction use are already included in the total land take for the Scheme assessed in Section 10.7, no further assessment is required here. The assessment of the magnitude of overall loss for hedgerows (County (Medium) value) as a result of the land take for the new motorway is Moderate and the significance of effects Moderate at all timescales. No additional mitigation is proposed and NRW do not favour hedgerow planting within the Gwent Levels SSSIs. This is because hedgerows along the field boundaries can result in overgrowth/shading of the reens and field ditches with adverse effects on aquatic macrophytes and invertebrates which are the important features of the SSSIs.

10.8.282 As explained in Section 10.7, the total loss of all grasslands as a result of the new section of motorway would amount to some 250 ha. Of this total some 71.9 ha would be in the areas required for temporary construction use. Since this is included in the overall figure for loss of grassland, no additional assessment is required here. The assessment of impacts without mitigation (other than that which is integral to the Scheme) is as follows.

- Species-rich grasslands (County (Medium) value): Moderate Adverse magnitude of impacts and effects of Moderate significance in the medium term becoming Minor Adverse magnitude of impacts and effects of Slight significance in the long term as the new grassland develops.
- Other non-SSSI grasslands (District (Low) value): Moderate Adverse magnitude of impacts and effects of Slight significance in the medium term becoming Minor Adverse magnitude of impacts and effects of Neutral or Slight significance in the long term.

10.8.283 The assessment of impacts with additional mitigation is as follows.

- Species-rich grasslands (County (Medium) value): Moderate Adverse magnitude of impacts and effects of Moderate significance in the medium term becoming Minor Adverse magnitude of impacts and effects of Slight significance in the long term as the new grassland develops.
- Other non-SSSI grasslands (District (Low) value): Moderate Adverse magnitude of impacts and effects of Slight significance in the medium term becoming Minor Adverse magnitude of impacts and effects of Neutral or Slight significance in the long term.

Potential Effects of Pollution from Inappropriate Storage of Chemicals or Spillages

10.8.284 There are areas of wet woodland adjacent to the proposed new section of motorway. These include areas of alder dominated woodland at Pwll Diwaelod, and wet scrub woodland within the Tata Steel site. These woodlands could potentially be affected by polluting discharges to associated watercourses or groundwater.

10.8.285 As explained in Chapter 3: Scheme Construction, appropriate measures for prevention of release of potentially polluting materials during use are outlined in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), the Outline Ground and Surface Water and Groundwater Management Plan (Annex G to Appendix 3.2) and would be set out in detail in the CEMP which would be in place before the start of construction.

Adherence to these measures, standard best practice guidance and Environment Agency Pollution Prevention Guidelines would significantly reduce the likelihood of an accidental pollution incident occurring.

Potential Hydrological Effects of the Earthworks

10.8.286 There is the potential for soil moisture to be affected by the new section of motorway in a number of ways. Cuttings and associated drainage works may result in increased drainage of land where water tables were previously high. New drainage systems and connections can result in drainage of formerly wet areas and potentially divert water to areas which were formerly relatively dry. Trees, particularly mature trees, will have developed root systems suited to the prevailing soil moisture conditions where they are growing. Whilst young trees are able to adjust to changes in soil moisture by changes in the pattern of root growth, old established trees are less able to accommodate such changes.

10.8.287 The main areas where there would be substantial excavations as part of the earthworks for the new section of motorway would be at the Castleton Interchange, at the borrow pit at Berryhill Farm, at the Magor Interchange, and at the borrow pit north east of Undy.

10.8.288 Most of the plantation woodland around the Castleton Interchange would be removed by the Scheme. There would only be relatively minor works adjacent to the existing woodlands at Pwll Diwaelod and so significant hydrological effects would not be expected on adjacent woodlands around the Castleton Interchange.

10.8.289 At Berryhill Farm, the small area of ancient woodland and conifer plantation would all be removed in order to construct the Scheme so there would be no additional impacts on woodland as a result of the excavation of the borrow pit.

10.8.290 At Magor, much of the existing plantation woodland along the existing M4, and small blocks of woodland at Knollbury would be included in the permanent land take for the Scheme. There are some small blocks of woodland close to the north of the new section of motorway to the east of Knollbury, but excavations in this area would be relatively shallow. Again significant effects beyond loss of woodland resulting from the land take would not be expected to be significant.

10.8.291 The borrow pit to the north east of Undy would be in an area of improved grassland with no nearby woodland.

10.8.292 Hedgerow shrubs are unlikely to be significantly affected by changes in soil moisture other than by significant raising of ground water tables or impedence of drainage resulting in waterlogging of root systems. Maintenance of drainage connections across the new section of motorway and, in the Levels section, continued management of the water levels in the reen system would ensure drainage regimes were maintained.

10.8.293 As for woodland considered above, hedgerow trees, particularly mature trees, will have developed root systems suited to the prevailing soil moisture conditions where they are growing. Whilst young trees are able to adjust to changes in soil moisture by changes in the pattern of root growth, old established trees are less able to accommodate such changes.

10.8.294 The main section of the works where hedgerows with trees would be in close proximity to significant excavations would be at the eastern end of the route north

of Magor and Undy, in the vicinity of Knollbury. In this section a number of hedgerows would be cut off and there is the potential for effects on trees in the remaining sections of hedge close to the excavation to be affected. Such trees are unlikely to die, but there could be some die-back of the canopy as the trees adjust to the changed soil moisture regime.

10.8.295 The potential hydrological effects on the grasslands within the Gwent Levels have been considered earlier in this section. Elsewhere, the grasslands in the vicinity of the new section of motorway are predominantly improved or semi-improved grasslands around the Castleton and Magor Interchanges. These grasslands would not be particularly sensitive to hydrological changes which may occur adjacent to the Scheme.

Temporary Severance/Fragmentation of Habitats or Corridors

10.8.296 Along most of the new section of motorway there would be no additional severance of woodland habitat as a result of construction beyond that which would result from the permanent land take for the Scheme.

10.8.297 However, at the eastern end of the route, the proposed haul road to Ifton Quarry would pass through the extreme southern tip of Roggiett Brake and between this wood and Rogiet Rectory Wood to the south. As the haul road would follow the line of an existing track through the wood which was used as a haul road when stone was transported from the quarry for construction of the Second Severn Crossing, other than some clearance of scrub and trimming of vegetation on either side of the haul road, there would be no significant loss of woodland. However, use of the haul road would result in some severance of woodland habitat.

10.8.298 As explained in Chapter 3: Scheme Construction, the normal working hours would be 07.00 to 19.00 hours (Monday to Friday), and 07.00 to 17.00 hours on Saturdays. The majority of construction activities would be undertaken within this period. In certain circumstances, specific works may have to be undertaken outside the normal working hours, including weekend working or extended hours during the summer months. Night working would also be required in some cases.

10.8.299 Thus, during the night time when most sensitive woodland animals (e.g. badger, dormouse) are active, for the majority of the construction period, there would be no disturbance.

10.8.300 Along most of the new section of motorway there would be no additional severance of hedgerows as a result of construction beyond that which would result from the permanent land take for the Scheme.

10.8.301 However, at the eastern end of the new section of motorway, the proposed haul road from Ifton Quarry would cut through a single hedgerow between Roggiett Brake and Minnett's Lane. At Minnett's Lane the haul road would leave the field at an existing gateway. This would require minimal additional hedgerow removal. The haul road would then cross Minnett's Lane and pass down the edge of the field to the west.

10.8.302 At the southern end of Minnett's Lane the haul road would turn west along the edge of the permanent land take and there would be no additional severance of hedgerows.

10.8.303 The temporary construction works would not result in any additional severance of grassland habitats over and above that caused by the permanent works.

Construction Lighting

10.8.304 As explained in Chapter 3: Scheme Construction, the normal working hours would be 07.00 to 19.00 hours (Monday to Friday), and 07.00 to 17.00 hours on Saturdays. The majority of construction activities would be undertaken within this period. 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 during the night time. Such task lighting would be positioned at low level on posts and directed at the most frequently used areas of work.

10.8.305 Inward facing security lighting would be provided at construction compounds on a 24 hour basis.

10.8.306 As explained in Chapter 3: Scheme Construction, a more detailed lighting strategy for the construction period would be developed to identify the type of lighting to be used and measures to be implemented to reduce light spill. The strategy would be agreed with the local planning authority and the regulator.

Pre-construction Surveys and Training

10.8.307 Mitigation for the Scheme would include pre-construction surveys in order to inform the hazel dormouse Method Statement and European Protected Species licence application, which would be obtained prior to the commencement of licenceable works.

10.8.308 Badgers typically use main setts for many years. However annex setts and outliers are less fixed. Taking this into account, mitigation measures would include pre-construction surveys of habitat of potential value to badgers in order to update the survey information set out in Confidential Appendices 10.37 and 10.38 and summarised in Section 10.4 and confirm the locations of any badger setts and areas of high badger activity which could be affected by the construction works. Results of the survey would inform the badger Method Statement and badger licence application under the Protection of Badgers Act 1992.

10.8.309 The provision of badger setts to replace those which would be lost based on the 2014 and 2015 survey information is described in Section 10.7.

10.8.310 All ecological mitigation works would be carried out under the guidance and, where necessary, the on-site instruction and watching brief of an appropriately qualified and experienced ECoW.

10.8.311 The mitigation measures would be included in site inductions and toolbox talks.

Culverts and Mammal Crossings

10.8.312 Mitigation would include the construction of culverts with adjacent 900 mm mammal tunnels, and other dry mammal crossings in accordance with guidelines published in DMRB Volume 10, Section 4 Part 2 (2001) and Part 4 (1999) and as described in Chapter 2: Scheme Description. The locations of these crossing points are shown on the EMP (Figure 2.6).

10.8.313 The construction of culverts and installation of mammal fencing would be undertaken during the first eight months of the works on the Caldicot Levels and the first nine months on the Wentlooge Levels (Appendix 3.1 Buildability Report). Mammal crossings would be constructed as soon as practicable during construction of the road formation.

Wildlife Fencing

10.8.314 In order to prevent access to working areas and to help guide badgers into culverts and mammal crossings, the mitigation strategy would include the pre-construction installation of mammal exclusion fencing suitable for badgers around the boundary of the works site (including temporary working areas) and up to the entrances of culverts with adjacent 900 mm mammal tunnels, and other mammal crossings, in accordance with guidelines published in DMRB Volume 10, Section 4 Part 2 (Highways Agency, 2001) and Part 4 (Highways Agency, 1999).

10.8.315 Fencing would be installed under the supervision of an appropriately experienced person so as to ensure there were no gaps along the fence line that badgers could push through, e.g. where the fencing abuts features such as hedges, stiles or fences.

10.8.316 The mitigation strategy for the Scheme would include monitoring of the mammal exclusion fencing throughout the construction phase. The ECoW would be responsible for ensuring regular monitoring is undertaken throughout the construction phase and repairs are made as soon as practicable.

Lowland Mixed Deciduous Woodland (Including Wet Woodland)

Assessment of Potential Effects

10.8.317 The magnitude of the likely impacts of the construction works on semi-natural broadleaved woodland habitat (County (Medium) value) taking account of the measures to protect against potential pollution, changes in soil moisture, and habitat severance in addition to that caused by the permanent land take for the Scheme, would be Minor Adverse and the significance of effects Slight as a result of severance arising from the use of the haul road to Ifton Quarry.

10.8.318 For plantation woodland (District (Low) value) the magnitude of the likely additional impacts of construction would be Minor and the significance of effects Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.8.319 No further mitigation is required beyond that which would be incorporated into the Scheme, the principles of which are set out in the Pre-CEMP (Appendix 3.2). Thus the magnitude of the likely impacts on semi-natural broadleaved woodland habitat would remain as Minor Adverse and the significance of effects as Slight.

10.8.320 Similarly for plantation woodland the magnitude of the likely impacts of construction would remain as Minor Adverse and the significance of effects Neutral or Slight.

Hedgerows

Assessment of Potential Effects

10.8.321 The magnitude of the likely impacts of the construction works on hedgerows (County (Medium) value) in the vicinity of the new section of motorway taking into account the mitigation measures included in the Scheme and included in the Pre-CEMP at Appendix 3.2, and potential changes in soil moisture and habitat severance, would be Minor Adverse and the significance of effects Slight.

Assessment of Effects with Additional Mitigation

10.8.322 No additional mitigation is proposed and so the magnitude of impacts would remain as Minor Adverse and the significance of effects Slight.

Lowland Meadow

Assessment of Potential Effects

10.8.323 The magnitude of the likely impacts of the construction works on grasslands, taking into account the mitigation measures included in the Scheme and included in the Pre-CEMP at Appendix 3.2, and generally valuing the grasslands outside the SSSI as of no more than District (Low) value, other than the species-rich grasslands which are valued at the County (Medium) value, are assessed as follows.

- Species-rich grasslands: Negligible Adverse leading to effects of Neutral or Slight significance.
- Other non-SSSI grasslands: Negligible Adverse leading to effects of Neutral or Slight significance.

Assessment of Effects with Additional Mitigation

10.8.324 No additional mitigation is proposed. Thus the magnitude of the effects would remain as follows.

- Species-rich grasslands: Negligible Adverse leading to effects of Neutral or Slight significance.
- Other non-SSSI grasslands: Negligible Adverse leading to effects of Neutral or Slight significance.

Dormouse

10.8.325 As part of the mitigation for the Scheme, due to the amount of habitat of known or potential value to dormice (locations of dormouse records are shown on Figure 10.8 and described in Appendices 10.9 and 10.26) that would be lost to construction, hazel dormice would be captured and translocated to an appropriate off-site receptor site prior to the commencement of construction.

10.8.326 The methodology for trapping, handling and translocation; and post-translocation monitoring and reporting would be undertaken in accordance with a European Protected Species Licence which would be obtained in advance of the works.

10.8.327 Prior to the commencement of translocation, the receptor site would be confirmed to contain adequate favourable habitat to support the translocated population of

dormice and would provide opportunities for a future expansion of the population (e.g. through habitat corridors to additional favourable habitat). If necessary, enhancement measures or management of the site would be undertaken in order to achieve a favourable condition prior to translocation. Should no suitable receptor site be found, it may be necessary to maintain the dormice as a captive population at a suitable facility for re-release once suitable habitat was available after completion of the Scheme. All measures would be detailed in the licence Method Statement and would be subject to NRW approval.

10.8.328 Reports of all captures and translocations would be maintained by the ECoW and provided on a regular basis to the Project Manager and NRW.

10.8.329 Outside the areas to be cleared, the mitigation strategy for the Scheme would include the establishment of a buffer zone around retained trees and scrub of known value to dormice. Buffer zones would be at least the width of the root protection zone of the trees/scrub. Buffer zones would exclude the tracking of heavy machinery and vehicles; storage of equipment, machinery or soils; and below-ground destructive works.

10.8.330 Where considered necessary by the ECoW, high visibility or construction fencing would be used to demarcate boundaries of buffer zones.

Assessment of Potential Effects

10.8.331 Taking into account the amount of habitat of known value to hazel dormice that would be lost to construction and, therefore, the potential for injuries and fatalities, the magnitude of the likely impact of construction on hazel dormice (of County (Medium) value) is assessed as Major Adverse leading to effects of Moderate or Large Adverse significance.

Assessment of Effects with Additional Mitigation

10.8.332 Taking into account the additional mitigation measures, primarily pre-construction trapping and translocation in accordance with a European Protected Species dormouse licence, and assuming the successful establishment of the population at a receptor site (or maintenance of a captive population and re-release), the magnitude of the likely impact on hazel dormice of construction with additional mitigation is assessed as Minor Adverse leading to effects of Slight Adverse significance.

Badger

10.8.333 No construction works would be carried out within 30 m of an active sett entrance (100 m in the case of highly disturbing works such as pile driving) without the appropriate licence. Where setts were directly affected by the works, new setts would be provided and the existing setts closed prior to the works commencing in the relevant area. As considered necessary by the ECoW and/or Site Manager, works-free protection zones would be marked out on site, such as with high-visibility fencing or coloured tape.

10.8.334 Results of the 2014 and 2015 badger surveys (Confidential Appendices 10.37 and 10.38) confirm the following badger setts to be located within or immediately adjacent to working areas.

- Main sett E (active).

- Main sett H (active in 2014; inactive late 2015).
- Main sett I (active).
- Outlier sett V (active).
- Outlier sett Q (active).
- Outlier sett J (active).
- Outlier sett M (disused).
- Outlier sett Y (disused).
- Outlier sett Z (disused).

10.8.335 Therefore, in order to protect any badgers that might be utilising the setts and prevent a breach of the Protection of Badgers Act 1992, badgers would need to be displaced from the setts prior to closing them.

10.8.336 As part of the mitigation for the Scheme, three artificial setts would be constructed in order to provide alternative setts for badgers that could be displaced from the three active main setts E, H and I. The artificial setts would be constructed prior to sett closures and would be of a design pre-approved by NRW through the badger licence application process.

10.8.337 Artificial setts would be constructed in areas that would enable badgers to continue to gain access to parts of their existing home range that contain significant areas of habitat of potential value.

10.8.338 Should pre-construction surveys report the presence of new main setts that would need to be closed, one artificial sett would be constructed in place of each new main sett to be closed.

10.8.339 Outlier setts are less frequently used or may be used on a temporary basis only and replacement setts for these would not be constructed.

10.8.340 The construction of artificial setts and closures of active setts would be carried out in accordance with the requirements of the NRW licence for badgers, which would be obtained prior to the commencement of licenced works.

10.8.341 As part of the mitigation strategy for the Scheme, the following measures would be set in place so as to minimise the potential for injuries or fatalities to badgers.

10.8.342 Toxic or otherwise potentially damaging stored materials or equipment would be secured against possible access by badgers.

10.8.343 Should any excavations greater than 0.5 m deep be located outside the mammal exclusion fencing, these excavations could be separately fenced; covered overnight where practicable; re-profiled so as to enable badgers to walk up a wall of the excavation; or a means of escape could be provided, such as wooden planks positioned against a wall as a ladder.

10.8.344 An emergency procedure protocol to be followed in the event of encountering a badger or discovering a sett, would be provided to contractors during inductions and/or toolbox talks.

10.8.345 An appropriately qualified and experienced ecologist (who could be the ECoW) would attend the site as soon as practicable in order to confirm reports of badger

activity, and to assess the need for further surveys to confirm the presence of badgers and/or the need for a development licence for badgers.

10.8.346 If an NRW licence for badgers is required for works to continue, works would be halted until a licence had been granted. Once a licence has been obtained, works in the area would then be completed in accordance with the requirements of the licence.

10.8.347 If a dead or injured badger is located, the ECoW or appropriately experienced ecologist instructed by the ECoW would determine the cause of death where possible (e.g. through speaking to site workers, inspecting the body and/or investigating site conditions). If the death is considered likely to be a result of construction works, the ecologist would assess the need for further mitigation.

10.8.348 A report of the findings and implications for construction would be produced by the ECoW and provided to the Project Manager as soon as practicable.

10.8.349 The ECoW would monitor the effectiveness of any new mitigation measures so as to ensure any amendments or additional measures are set in place as soon as practicable.

Assessment of Potential Effects

10.8.350 Taking into account measures to limit the potential for and likely impact of pollutant runoff and light spill during construction together with the planting and creation of replacement and new habitats of value to badgers (including woodland, scrub rough grassland) as shown on the EMP at (Figure 2.6), the magnitude of the likely impact of construction without mitigation on badgers (of District (Low) value) is assessed as Moderate Adverse and the significance of effects as Slight, largely due to lack of replacement badger setts, the lack of mammal crossings, the absence of mammal exclusion fencing around working areas and the potential risk to badgers of culverts designed without measures to ensure safe dry passage during times of flood.

Assessment of Effects with Additional Mitigation

10.8.351 Taking into account additional mitigation measures, in particular pre-construction surveys to inform the mitigation strategy, the provision of three replacement badger setts, provision of mammal crossings, design of culverts with adjacent 900 mm mammal tunnels, the installation of mammal exclusion fencing around boundaries of the work site, buffer zones to protect setts, and the emergency procedures to be set in place, the magnitude of the likely impact of construction with mitigation on badgers is assessed as Minor Adverse leading to effects of Neutral or Slight significance.

Hedgehog

10.8.352 Prior to the commencement of construction within areas of high potential value to hedgehogs (i.e. woodlands, areas of dense scrub and mature hedgerows with good ground cover), an inspection would be undertaken by an appropriately experienced ecologist in order to locate any habitat features beneath which hedgehogs could be resting and to capture and relocate any hedgehogs that might be present to appropriate habitat at the edge of the Scheme outside working areas. Although some hedgehogs roam widely, others show strong site fidelity but can share home ranges with other hedgehogs of either sex. Home

ranges vary in size depending on the resources available. Morris and Reeve (cited in Wildlife on Line, 2014) suggest that in the UK the average home range of male hedgehogs is 32 ha and females is 10 ha. Therefore, release sites would be located as close to the site of origin as possible in order to ensure release into the same home range.

10.8.353 Reports of all captures and translocations would be maintained by the ECoW and would be provided on a regular basis to the Project Manager and to NRW.

Assessment of Potential Effects

10.8.354 Taking into account measures included as part of the Scheme, in particular measures to limit the potential for and likely impact of pollutants and light spill, the magnitude of the likely impact of construction without mitigation on hedgehog (of District (Low) value) is assessed as Major Adverse leading to effects of Slight or Moderate significance primarily due to the potential for injuries and fatalities and disruption to movement.

Assessment of Effects with Additional Mitigation

10.8.355 Taking into account mitigation measures, primarily the pre-construction translocation of hedgehogs from the construction site, the installation of mammal exclusion fencing, the provision of mammal crossings, and the construction of box culverts with adjacent 900 mm mammal tunnels as soon as practicable, the magnitude of the likely impact of construction with mitigation on hedgehogs is assessed as Minor Adverse leading to effects of Neutral or Slight significance.

Industrial Land

10.8.356 The Industrial Land Ecological Unit includes the following VERS.

- Open mosaic habitats on previously developed land.
- Reptiles (Common lizard, slow worm).
- Terrestrial invertebrates.

10.8.357 The overall impacts of the construction of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme and then the additional mitigation proposed. Then the impacts on each of the relevant VERs is assessed.

10.8.358 As explained in Section 10.4 there are areas of ‘brownfield’ land at Great Pencarn – Duffryn, in Newport Docks, south of the Solutia works, south of the Tata Steelworks at Llanwern and at Green Moor.

10.8.359 The effects of construction of the new section of motorway on grass snake are considered separately in this chapter under Reens ditches, reedbeds and ponds. The other two reptiles found in the surveys undertaken for the Scheme were common lizard and slow worm which were recorded in areas of brownfield land.

10.8.360 This section also assesses the impacts on the assemblages of terrestrial invertebrates recorded at Tata Steel and Newport Docks, and so associated with brownfield sites.

10.8.361 The effects of the new section of motorway on shrill carder bee are considered under the Grazing Marsh habitat earlier in this Section.

Temporary Habitat Loss

10.8.362 The brownfield site at Great Pencarn – Duffryn would be almost entirely taken up by the main construction compound for the Scheme. This has already been included in the assessment of the land take for the Scheme in Section 10.7.

10.8.363 As explained in Section 10.7, in addition to the land required for the permanent works in Newport Docks, a considerable area alongside and to the east of the proposed Docks Way link, as well as smaller areas around the junction of the link with the new section of motorway, would be occupied by temporary construction sites. This has already been included in the assessment of the land take for the Scheme in Section 10.7.

10.8.364 As also explained in Section 10.7, to the east of the River Usk there would be losses of areas of vegetated brownfield land to provide construction areas for the viaduct and River Usk Crossing, and these have also been included in the assessment of the land take for the Scheme in Section 10.7.

10.8.365 There would also be extensive construction areas on brownfield land, including sludge lagoons and their embankments, within the Tata Steel land, also included in the assessment in Section 10.7.

10.8.366 As explained in Chapter 3: Scheme Construction, following completion of the works all temporary construction work sites would be removed and the land affected would be restored. In restoring the construction sites at Duffryn, within Newport Docks and Tata Steel, so far as practicable a mosaic of habitat types providing some of the characteristics of brownfield land would be provided.

Potential Effects of Pollution from Inappropriate Storage of Chemicals or Spillages

10.8.367 As explained in Chapter 3: Scheme Construction, appropriate measures for prevention of release of potentially polluting materials during use are outlined in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), the Outline Ground and Surface Water and Groundwater Management Plan (Annex G to Appendix 3.2) and would be set out in detail in the CEMP which would be in place before the start of construction. Adherence to these measures, standard best practice guidance and Environment Agency Pollution Prevention Guidelines would significantly reduce the likelihood of an accidental pollution incident occurring.

Potential Hydrological Effects of the Earthworks

10.8.368 The industrial sites at Great Pencarn and Newport Docks are generally relatively open mosaic habitats of grassland and scrub and would be relatively insensitive to changes in the soil moisture regime. At Tata Steel the site includes a number of former lagoons with relatively high water tables and there may be some temporary dewatering of these areas during the works as a result of removal and replacement of lagoon embankments.

Temporary Severance/Fragmentation of Habitats or Corridors

10.8.369 The construction areas within the industrial land at Great Pencarn, Newport Docks and Tata Steel would be contiguous with the permanent land take for the road. The extent of the land take for the construction areas has been included in

the assessments in Section 10.7. There would thus be no significant additional severance of these habitats as a result of the construction of the new section of motorway.

Construction Lighting

10.8.370 As explained in Chapter 3: Scheme Construction, the normal working hours would be 07.00 to 19.00 hours (Monday to Friday), and 07.00 to 17.00 hours on Saturdays. The majority of construction activities would be undertaken within this period. 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 during the night time. Such task lighting would be positioned at low level on posts and directed at the most frequently used areas of work.

10.8.371 Inward facing security lighting would be provided at construction compounds on a 24 hour basis.

10.8.372 As explained in Chapter 3: Scheme Construction a more detailed lighting strategy for the construction period would be developed to identify the type of lighting to be used and measures to be implemented to reduce light spill. The strategy would be agreed with the local planning authority and the regulator.

Pre-construction Surveys and Training

10.8.373 No pre-construction surveys are proposed for the areas of industrial land. All ecological mitigation works would be carried out under the guidance and, where necessary, the on-site instruction and watching brief of an appropriately qualified and experienced ECoW.

10.8.374 The mitigation measures would be included in site inductions and toolbox talks.

Open Mosaic Habitats on Previously Developed Land

Assessment of Potential Effects

10.8.375 As explained above, the magnitude of the loss of open mosaic habitats on previously developed land (County (Medium) value) has been assessed under the overall land take for the Scheme in Section 10.7. The magnitude of the additional impacts of construction on this habitat are assessed as Minor Adverse and the significance of effects as Slight.

Assessment of Effects with Additional Mitigation

10.8.376 The sympathetic restoration of the construction areas at Great Pencarn, Newport Docks and Tata Steel has been considered in Section 10.7. No additional mitigation for the construction effects on the open mosaic habitats on previously developed land is proposed and the assessment of the magnitude of the additional impacts of constructon remains as Minor Adverse and the significance of effects as Slight.

Reptiles (Common Lizard, Slow Worm)

10.8.377 Prior to commencement of construction in areas where common lizard and slow worm populations have been identified, reptile fencing would be installed and

reptiles would be captured and transferred to suitable habitat on the margin of the Scheme, or to suitable habitat within the SSSI mitigation areas (Appendix 10.35) or elsewhere by agreement. The detailed method statement for the capture and translocation, and the location of the receptor site or sites would be agreed with NRW in advance.

Assessment of Potential Effects

10.8.378 The loss of reptile habitat of Common lizard and Slow worm (of District (Low) value) within the construction areas has been considered as part of the overall land take for the Scheme in Section 10.7. The magnitude of the additional construction impacts on the populations of these species is assessed as Moderate Adverse and the significance of effects Slight.

Assessment of Effects with Additional Mitigation

10.8.379 Additional mitigation would comprise the pre-construction capture and translocation of the populations of Common lizard and Slow worm. Taking this into account the assessment of the magnitude of the additional impacts of constructon would be Minor Adverse and the significance of effects as Neutral or Slight.

Terrestrial Invertebrates

Assessment of Potential Effects

10.8.380 The loss of habitat for terrestrial invertebrates (Regional (Medium) value) within the construction areas has been considered as part of the overall land take for the Scheme in Section 10.7. The magnitude of the additional construction impacts on the invertebrate assemblage is assessed as Minor Adverse and the significance of effects as Slight.

Assessment of Effects with Additional Mitigation

10.8.381 The sympathetic restoration of the construction areas at Great Pencarn, Newport Docks and Tata Steel has also been considered in Section 10.7. No additional mitigation for construction effects on terrestrial invertebrates are proposed and the assessment of the magnitude of the additional impacts of construction remains as Minor Adverse and the significance of effects as Slight.

Bats

10.8.382 All ecological mitigation works described below would be carried out under the guidance and where necessary, the on-site instruction and watching brief of an appropriately qualified and experienced ECoW and where required, the bat licenced ecologist.

10.8.383 Mitigation measures described below would be included in site inductions and toolbox talks and would be detailed in the Bat Method Statement that would support an application for a European Protected Species Licence.

Potential for Injury or Fatality – Roosting Bats

10.8.384 Removal of bat roosts prior to construction would be undertaken in accordance with the requirements of a European Protected Species licence and associated

Method Statement. It is envisaged that this would include measures designed to reduce the risk of mortality, such as the destruction of bat roosts at a time of year when bats would be least likely to be present; the searching of habitat prior to demolition for any roosting bats; the capture and translocation of any roosting bats to pre-installed bat roost boxes; and/or methods to encourage bats to leave the roosts prior to destruction e.g. use of deterrent lighting.

Displacement of Roosting Bats

10.8.385 The impact of the loss of bat roosts is considered as part of the assessment of land take effects in Section 10.7 above. However, in addition to the effect of habitat loss, the loss of a bat roost would result in a displacement effect on bats. In accordance with a European Protected Species licence for bats, all roosting bats would be captured and relocated to bat roost boxes suitable for the species of bat being displaced.

10.8.386 Should displacement and relocation of bats result in the loss of, or reduced access to favourable foraging sites, alternative roosting sites and/or other bats in the area, the effect could be significant with regard to the long term viability of the population.

10.8.387 Therefore, in order to minimise the impact of displacement, a bat barn would be provided north of Magor. Bat boxes would be provided elsewhere within the Scheme, within the SSSI mitigation areas, or elsewhere by agreement. Locations would be selected so as to provide good habitat connectivity to surrounding foraging habitat (i.e. habitat not separated from the new roost site by the construction site), and good habitat connectivity to features installed along the new road as potential crossing points (i.e. box culverts, mammal crossings, underpasses and overbridges, described under *Disruption of bat movement* below). If a bat roost is found to be present in buildings to be demolished at Berryhill Farm, consideration would be given to provision of a further bat barn within the Scheme in this area.

Disruption of Bat Movement

10.8.388 Major roads can present a barrier to the movement of some bat species. Berthinussen and Altringham (2012) recorded a significant reduction in bat activity up to 1.6 km from an 80 km section of the M6 in Cumbria, England. This reduction in activity was considered in part to be due to the barrier effect of major roads.

10.8.389 Although some bat species such as pipistrelles will travel across open spaces in excess of 200 m, others will follow habitat corridors such as hedgerows, areas of scrub and woodland edge in order to commute across the landscape (Highways Agency, 2011). Studies of flight behaviour by Knight (2006) showed that lesser horseshoe bats do not tend to cross open fields and instead appear to favour commuting alongside habitat corridors such as hedgerows, as do greater horseshoe bats, which appear to favour commuting close to corridors of vegetation such as woodland edges, hedgerows, trees and vegetated watercourses (Natural England, 2010). Where these corridors are relatively low-level (e.g. hedgerows less than 3 m in height), Knight (2006) reported that lesser horseshoe bats tend to fly at low level (i.e. between approximately 0.3 m above ground-level and up to the height of the vegetation) and close to the vegetation (i.e. at a distance of no more than approximately 1.5 m from the habitat corridor).

Despite the above findings, Knight (2006) also recorded some lesser horseshoe bats crossing over roads, indicating that under some circumstances roads do not necessarily discourage movement of horseshoe bats.

10.8.390 Therefore, the loss of habitat corridors along the construction corridor, such as hedgerows, would have an impact on the movement of some bat species.

10.8.391 Research commissioned by the Highways Agency (2011) confirmed that many bat species, in particular low-level gleaning species, will use underpasses (including culverts) to cross roads, particularly if spacious and unlit. However, the type of underpass appears to have an impact on the potential for use by bats. Research indicates some patterns in species use of underpasses, as follows.

- In general, larger underpasses appear more favourable to most species (Highways Agency, 2011; Boonman, 2011).
- Bats do not appear to be deterred by the length of an underpass (Boonman, 2011).
- Species requiring larger underpasses are generally more likely to cross over the road at height more readily (Highways Agency 2008).

Lesser Horseshoe Bat

- A study in 2009 and 2010 at three underpasses below a four lane motorway in Ennis, western Ireland, reported the majority of lesser horseshoe bats recorded crossing the road did so using an underpass (58 bat passes over 16 nights) and only a small proportion were recorded flying over the road (1 bat pass in 16 nights) (Abbott *et al*. 2012).
- Lesser horseshoe bats have been recorded using culverts with a diameter of 1.2 m over 90 m in length beneath a dual carriageway (R Green pers. comm. and as cited in Highways Agency 2008). However, the Highways Agency (2008) recommends the largest practicable size of culvert should be used in order to increase the probability of use, and suggests that 2.5 m diameter underpasses should be a minimum for species such as lesser horseshoe bats.
- Limpens et al. (2005) suggests suitable crossing points for lesser horseshoe bats would be culverts 1 m height x 1 m width, or tunnels 4-6 m height x 4-6 m width.

Greater Horseshoe Bat

- Billington (2003) reported greater horseshoe bats using tunnels beneath the A38.
- Greater horseshoe bats have been recorded flying through elliptical tunnels of 1.8 m and 2.2 m in diameter (Wray *et al*. 2005).
- Limpens et al. (2005) suggested suitable crossing points for greater horseshoe bats would be tunnels 4-6 m in height x 4-6 m in width.

Brown Long-eared Bat

- Recorded using underpasses (Boonman 2005).
- Limpens *et al*. (2005) suggested suitable crossing points for brown long-eared bats would be tunnels 4-6 m in height x 4-6 m in width.

Natterer's Bat

- Natterer's bats have been recorded using underpasses (Boonman, 2005).
- The largest practical size of culvert should be used to increase the chances of use by Natterer's bats. The Highways Agency (2008) suggest a 2.5 m diameter should be the minimum. Limpens et al. (2005) suggests suitable profiles for culverts would be 1 m^2, and for tunnels would be 4-6 m^2.
- Natterer's bats have been recorded using tunnels 1.5 m high x 2 m wide x >30m long (Highways Agency, 2011; Bach *et al.* 2004) and tunnels 4 m wide x 5 m high x 45 m long (Bach *et al*. 2004).
- Bach *et al*. (2004) reported that Natterer's bats can use bridges; however, only in very low numbers.
- The Highways Agency (2008) suggests the largest practicable size of culvert and a minimum diameter of 2.5 m should be used in order to increase the chances of use by Natterer's bats.
- Limpens *et al*. (2005) suggests suitable profiles for culverts should be 1 m^2, and suitable profiles for tunnels would be 4-6 m^2.

Bechstein's Bat

- Bechstein's bats have been recorded passing through tunnels 4.5 m wide x 4 m high x 31 m long (Highways Agency, 2011).
- Limpens *et al.* (2005) suggested suitable crossing points for Bechstein's bats would be tunnels 6 m in height x 6 m in width.

Whiskered/Brandt's Bat

- Brandt's bats have been recorded passing through tunnels 4.5 m wide x 4 m high x 31 m long (Highways Agency, 2011) and tunnels 4 m wide x 5 m high x 45 m long (Bach *et al*. 2004).
- Limpens *et al*. (2005) suggested suitable crossing points for whiskered/Brandt's bats would be tunnels 4-6 m in height x 4-6 m in width.

Barbastelle Bat

- Bach *et al* (2004) confirmed the use of tunnels 4.5 m wide x 4 m high x 31 m long by barbastelle bats.
- Brinkmann *et al* (2003) recommend underpasses of 4.5 m high x 4-6m wide for barbastelle bats.
- Limpens *et al*. (2005) suggested suitable crossing points for barbastelle bats would be tunnels 4-6 m in height x 4-6 m in width.

Daubenton's Bat

- Daubenton's bats have been recorded using tunnels 1.5 m high x 2 m wide x >30m long (Highways Agency, 2011).
- Boonman (2011) regularly recorded Daubenton's bats at the entrance to and inside surveyed culverts. Culvert cross sections of 5.4 m^2 resulted in an 80% probability of use; 6.5 m^2 cross section resulted in a 90% probability of use; and 7.4 m^2 cross section resulted in a 95% probability of use. The lowest

cross sectional area suitable for the species was recorded to be 1.2 m^2 (with a pass rate of 0-0.55/hour) – 2.2 m^2 (with a pass rate of >0.55/hour).

- Boonman (2011) reported the height of culverts was a significant factor for Daubenton's bats: the lowest height used by Daubenton's bats was 0.4 m (with a pass rate of 0-0.55 /hour) – 0.9 m (with a pass rate of >0.55 /hour).
- Daubenton's bats will use tunnels with watercourses (Bach *et al*. 2004).
- Limpens (2005) recommended culverts of 1 m height x 2 m width; bridges over water; or tunnels 4-6 m in height and width.

Common Pipistrelle

- Boonman (2011) reported common pipistrelles to be regularly present at entrances to and inside surveyed culverts.
- Boonman (2011) reported the number of passes recorded inside a culvert was positively correlated to the cross section. The lowest cross sectional area of an underpass used by common pipistrelles was 8.0 m^2 (i.e. passes at a rate of 0-0.55/hour) and 7.5 m^2 (at a rate of >0.55 passes/hour). Culvert cross sections of 36 m^2 resulted in 80% probability of use; 42 m^2 resulted in 90% probability of use; and 47 m^2 cross sections resulted in 95% probability of use.
- Boonman (2011) reported that culvert width is a significant factor in determining use by common pipistrelles but less significant than height. The lowest height of a culvert used by any number of common pipistrelles was 1.5 m.
- Common pipistrelles have been recorded using tunnels 4-4.5 m wide x 4-5 m high x 31-45 m long (Bach *et al*. 2004).
- Bach *et al*. (2004) reported that common pipistrelles can use bridges; however, only in very low numbers.
- Common pipistrelles have been recorded passing through tunnels 4.5 m wide x 4 m high x 31 m long (Highways Agency, 2011).
- Limpens *et al.* (2005) suggested suitable crossing points for common pipistrelle bats would be tunnels 4-6 m in height x 4-6 m in width.

Soprano Pipistrelle

- Limpens *et al*. (2005) suggested suitable crossing points for soprano pipistrelle bats would be tunnels 4-6 m in height x 4-6 m in width.

Nathusius' Bat

- Limpens *et al*. (2005) suggested suitable crossing points for Nathusius' pipistrelle bats would be tunnels 4-6 m in height x 4-6 m in width.

Serotine Bat

- Boonman (2011) regularly recorded serotine bats at the entrance to studied culverts (31 of 54 culverts); however, they were only recorded inside three very large culverts (i.e. 120 m^2, 124 m^2 and 140 m^2).
- Bach *et al.* (2004) reported that serotine bats have been recorded crossing motorways using bridges and tended to avoid lit areas.

- Research in the Netherlands has shown that serotine bats require viaducts to be at least 6 to 7 m in height and 5 to 7 m in width (Highways Agency, 2008b).
- Limpens et al. (2005) suggested suitable crossing points for serotine bats should be tunnels 6 m in height x 6 m in width.

Noctule Bat

- Noctule bats have been recorded passing through tunnels (e.g. records have been reported for tunnel 4-4.5 m wide x 4-5 m high x 31-45 m long); however, records of this occurring are very limited (Bach *et al*. 2004; Highways Agency, 2011).
- Boonman (2011) regularly recorded noctules at the entrance to culverts (21 of 54 surveyed culverts); however, they were never recorded passing through the culverts.
- Limpens *et al*. (2005) suggested suitable crossing points for noctules should be tunnels 6 m in height x 6 m in width.

Leisler's Bat

- Leisler's bats appear to favour flying over roads, rather than using underpasses (Abbott *et al*. 2012).

10.8.392 Other environmental factors may also affect the probability of a bat using a culvert, including the distance from a roost and, for Daubenton's bats, an association with a watercourse (Highways Agency, 2011).

10.8.393 Therefore, due to the potential for some bat species to cross over the new section of motorway or for the new section of motorway to present a barrier to the movement of some bats, the Scheme would include box culverts along reens with adjacent dry tunnels and dry mammal crossings (tunnels) along the route of the new road (as described in Chapter 2: Scheme Description). Overbridges constructed as part of the Scheme would also provide potential crossing points for bats.

10.8.394 In addition to high and very high value activity sites, mammal crossings, culverts, underpasses and overbridges would be constructed at other less well-used locations along the route (as shown on the EMP Figure 2.6). This would increase the potential crossing points for use by bats, including any that might chose to alter commuting routes in response to construction works.

10.8.395 The construction of these potential bat crossing points would be completed as soon as practicable during construction so as to minimise any impacts on the movements of bats that are less likely to commute across open spaces.

10.8.396 Although bats will try to locate alternative commuting routes when necessary, some species such as horseshoe bats are considered to be less likely to immediately alter their traditional commuting routes than other more adaptable species such as pipistrelles, and therefore may be more affected by the clearance of vegetation along the construction corridor. In order to improve the probability of bats finding and using crossing points (including culverts), in accordance with recommendations published by the Highways Agency (2011), crossing points would be constructed along, or as close as practicable to, sites where bat activity has been recorded to be high or very high (i.e. at locations

where an average of >500 bat passes were recorded per survey visit in 2014 and/or 2015; Appendices 10.7 and 10.23 and Figure 10.8). This would reduce the impact of construction on species less flexible with regard to their habitat choice and ability to amend their commuting routes.

10.8.397 Changes to commuting routes required as a result of habitat clearance may result in increased energy expenditure for some bats. A need to change commuting routes may also result in a reliance on less favourable foraging or roosting sites and/or changes to population interactions, which in the long term could result in adverse population effects including in-breeding (Highways Agency, 2011).

10.8.398 Strategic planting of trees and scrub can help to guide bats towards entrances to culverts and other potential crossing points, thereby increasing the potential for use by bats (Highways Agency, 2011). Therefore, where practicable, planting would be designed so as to guide bats into culverts, mammal crossings, underpasses and/or overbridges, in particular those crossing points associated with high and very high value bat habitat (as described in Table 10.18).

10.8.399 Planting would be carried out as soon as practicable and as soon as it can be confirmed that ongoing construction would not result in damage to new plants.

10.8.400 Whilst planting becomes established, in order to help guide bats to crossing points, artificial “bat corridors” (e.g. lines of hazel hurdle fencing) would be installed between crossing points and retained habitats in or connected to high and very high bat activity areas (Appendices 10.7 and 10.23 and Figure 10.8). These bat corridors would be installed during night time hours between at least March and September inclusive (the main period of bat activity) and until landscape planting has become sufficiently developed to provide a permanent alternative.

10.8.401 Berryhill Farm and Fair Orchard Farm buildings would be surveyed prior to construction in order to confirm the presence or likely absence of bats roosts. Should these buildings contain roosts and should it be possible to retain the buildings and, therefore, the roosts, the existing A48 and Lighthouse Road would continue to provide potential access routes to the roosts as well as crossing points across the new section of motorway, thereby helping to minimise the potential impact on roosting bats (bats were recorded commuting along the A48 and Lighthouse Road during bat activity surveys completed in 2014 (Appendix 10.7)). As referred to above, if a bat roost is found to be present in buildings to be demolished at Berryhill Farm, consideration would be given to provision of a further bat barn within this area.

10.8.402 Considering the above, the potential for bats recorded along the route to utilise underpasses including culverts is summarised in Table 10.18.

Table 10.18: Crossing Points for Bats at Locations of High to Very High Level Bat Activity and for Rarer Bat Species

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
22 (2015)	n/a	1,800	Mammal crossing	Bat passes: average of 500-1500 per survey visit. Species: – regional value to Myotis (small numbers); and – county value to pipistrelles (large numbers).	Dry tunnel, 900 mm diameter. To be located in the field immediately to the south of the static detector location, less than 100 m away. Hedgerow that currently connects the two locations would be replaced by woodland planting. Planting would help guide bats towards both entrances to the crossing. The existing A48 and new slip road immediately to the north of Berryhill Farm buildings (where commuting bats were recorded in 2014 (Appendix 10.7)) would continue to provide an alternative commuting route across the new road. Tree planting would also be located so as to help guide bats to this crossing point. May be used by some: – Daubenton's bats, should they be present - Boonman (2011) recorded Daubenton's bats using culverts of 0.4 – 0.9 m height; however, Limpens (2005) recommends culverts 1 m height x 2 m width or tunnels 4-6 m height x width. Less likely to be used by: – pipistrelle bats - Boonman (2011) reported pipistrelles using culverts a minimum height of 1.5 m, but this is not a preferred height and recommended tunnel profiles are of 4-6 m height and width (Limpens 2005); and – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005).
23 and 25 (2015)	SMN-0450	4,525	Elm Culvert	Bat passes: to west of new road, >2500 passes during one survey visit and >1500 on average; to east of new road 250-500 passes on average, indicating fewer bats would typically	Culvert (1200 mm diameter, approximately 60 m long) located approximately 100 m to the east of the static detector locations is a box culvert and between approximately 100 m and 200 m to the west would be a mammal crossing (dry tunnel, 900 mm diameter). Woodland

Static detector location ref:	Culvert ref. Figure 2.6	Chainage	Name	Bat activity and value to foraging and commuting bats (as defined by Wray *et al*. 2010)	Description of crossing feature
				cross the new road at this point. Species: – regional value to noctules (individuals (location 25) to small numbers (location 23)); – regional value to Myotis and possible Leisler's bats (Leisler's could have been noctules) (individuals); – regional value to serotines (location 25) (individuals); – district (location 23) to county (location 25) value to pipistrelles (small (location 23) to large (location 25) numbers); and – district value to brown long-eared bats (individuals).	planting both sides of new road would help to guide bats towards the culvert. In addition, the overbridge along Church Lane (where commuting bats were recorded in 2014 (Appendix 10.7)) would continue to provide an alternative crossing point (see 27). Culvert and mammal crossing may be used by some: May be used by some: – Daubenton's bats, should they be present - Boonman (2011) recorded Daubenton's bats using culverts of 0.4 – 0.9 m height; however, Limpens (2005) recommends culverts 1 m height x 2 m width or tunnels 4-6 m height x width. Less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – pipistrelle bats (Limpens 2005; Boonman 2011; Highways Agency 2011); – serotines (Boonman 2011); – Leisler's bats (Abbott et al. 2012, 2012); – noctules (Boonman 2011; Limpens 2005); and – brown long-eared bats (Limpens 2005).
27 (2015)	SBR-0460	4,625	Church Lane Overbridge	Bat passes: >1500 on average per survey visit and >2500 during one survey visit. Species: – regional value to Myotis (small numbers); – regional value to serotines, noctules and possible Leisler's bats (individuals); – county value to pipistrelles (large	Overbridge carrying side road over the new road. Carriageway 5.3 m wide, located alongside the static detector site. The bridge would provide a potential commuting route for bats. However, overbridges do not appear to be favoured crossing methods for bats (Bach *et al.* 2004; Abbott *pers.comm*. cited in Highways Agency 2011) and, therefore, bats may prefer to cross the new motorway (see culvert below).
	SMN-0460	4,625	Church Lane Culvert		Culvert (1200 mm diameter, approximately 38 m long) to cross new side road to the south of the new motorway, adjacent to static detector location. Woodland planting both

Static detector location ref:	Culvert ref. Figure 2.6	Chainage	Name	Bat activity and value to foraging and commuting bats (as defined by Wray *et al*. 2010)	Description of crossing feature
				numbers); and – district value to brown long-eared bats (individuals).	sides of the new side road and to the south of the new motorway would help to guide bats towards the culvert. Culvert may be used by some: – Daubenton's bats, should they be present - Boonman (2011) recorded Daubenton's bats using culverts of 0.4 – 0.9 m height; however, Limpens (2005) recommends culverts 1 m height x 2 m width or tunnels 4-6 m height x width. Less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – pipistrelle bats (Limpens 2005; Boonman 2011; Highways Agency 2011); – serotines (Boonman 2011); – Leisler's bats (Abbott et al. 2012, 2012); – noctules (Boonman 2011; Limpens 2005); and – brown long-eared bats (Limpens 2005).
3 (2014)	See 27	4,825	See 27	Bat passes: >500 average bat passes per survey visit. Species: – regional value to Myotis (small numbers); – regional value to noctules (individuals); and – county value to pipistrelles (large numbers).	See 27
29 and 30 (2015)	SMN-0550	5,525	Percoed Reen Culvert	Bat passes: to west of new road, >2500 passes during one survey and >1500 on average. However, where new road crosses reen, 100-250 passes on average. Therefore, potential for a	Realigned reen along which static detectors are located. Box culvert. Internal dimensions: 1.8 x 1.8 x 54 m. Scrub and tree planting to the north and south would help guide some bats towards the culvert.

Static detector location ref:	Culvert ref. Figure 2.6	Chainage	Name	Bat activity and value to foraging and commuting bats (as defined by Wray *et al*. 2010)	Description of crossing feature
				reduced number of bats to use the full length of the reen. Species: – regional value to Myotis (individuals (location 30) to small (location 29) numbers); – regional value to serotines, noctules, possible Leisler's bats and Nathusius (location 30 only) (individuals); – county value to pipistrelles (small (location 30) to large (location 29) numbers); and – district value to brown long-eared bats (individuals).	Culvert may be used by some: – Daubenton's bats, if present (Boonman 2011; Limpens 2005); and – pipistrelle bats (Boonman 2011) ; however, Limpens et al. (2005) recommended tunnels 4-6 m in height x 4-6 m in width.. Culvert unlikely/less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – barbastelle bats (Limpens 2005)); – noctules (Highways Agency 2011; Boonman 2011; Limpens 2005); – Leisler's bats (Abbott et al. 2012, 2012); – Nathusius' bats (Limpens 2005); – serotine bats (limpens 2005; Highways Agency 2008; Boonman 2011); and – brown long-eared (Limpens 2005). However, Percoed NMU Bridge will still be available for use for some bats, see below.
	SBR-0580	5,775	Percoed NMU Bridge	As above.	Newport/Cardiff cycle way to pass over the new road. Length: 188 m. Clear span: 11.6 m. Some potential to utilise the bridge as a crossing point - Halcrow (unpublished 2008, cited in Highways Agency 2011) recorded bats flying along narrow bridges (with spans of <5 - 15m), including pipistrelles, Myotis and serotines; however, appears not to be a preferred crossing method (Bach et al. 2004) and, therefore, bats may prefer to cross the new motorway.
4 (2014)	See 29/30	See 29/30	See 29/30	Bat passes: >500 average bat passes per survey visit.	See 29/30

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
				Species: – regional value to Myotis (small numbers); – regional value to noctules, Leisler's and Nathusius' bats (individuals); and – county value to pipistrelles (large numbers).	
18 (2015)	n/a	6,130	Mammal crossing	Bat passes: 500-1500 average bat passes per survey visit. Surrounding activity 250-500 average passes per visit, indicating not all bats would travel across the new road. Species: – regional value to noctules (small numbers); – regional value to Myotis, Leisler's bats and possible serotines (individuals); – county value to pipistrelles (large numbers); and – district value to brown long-eared bats (individuals).	Tunnel 900 mm diameter. To be installed in south-west corner of field where the static detector was located. Tree and scrub planting to south of the new road would help guide bats towards the southern entrance of the crossing point. May be used by some bats of the following species: – Daubenton's bats, if present - Boonman (2011) recorded Daubenton's bats using culverts of 0.4-0.9 m height; however, Limpens (2005) recommends culverts 1 m height x 2 m width or tunnels 4-6 m height x width; Culvert less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – pipistrelle bats (Limpens 2005; Boonman 2011; Highways Agency 2011); – serotines (Boonman 2011); – Leisler's bats (Abbott et al. 2012, 2012); – noctules (Boonman 2011; Limpens 2005); and – brown long-eared bats (Limpens 2005).
46 (2015)	n/a	6,500	n/a	Bat passes: 500-1500 average bat passes per survey visit. Surrounding activity 250-500 average passes per visit, indicating not all bats would travel across the new road.	Proposed underbridge carrying new road over the South Wales to London Mainline. The structure would span four tracks of the railway, 27.9 m, and would have a minimum headroom of 5.45 m and length of 191 m.

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
				Species: – regional value to Myotis, Leisler's bats and noctules (individuals); – county value to pipistrelles (large numbers); and – district value to brown long-eared bats (individuals).	Mammal crossing (900 mm diameter) to the north of the railway line and less than 50 to the north west of the bat detector location. Tree planting to the south of the railway line would help guide some bats more than 50 m further to the west of the railway tunnel and towards the section of the railway line located opposite the mammal crossing.. May be used by some bats of the following species: – Daubenton's bats, if present - Boonman (2011) recorded Daubenton's bats using culverts of 0.4-0.9 m height; however, Limpens (2005) recommends culverts 1 m height x 2 m width or tunnels 4-6 m height x width; Less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – pipistrelle bats (Limpens 2005; Boonman 2011; Highways Agency 2011); – Leisler's bats (Abbott et al. 2012, 2012); – noctules (Boonman 2011; Limpens 2005); and – brown long-eared bats (Limpens 2005). Morfa Gonw Reen Culvert is located 400 m to the east of the detector location and is connected to it by tree and shrub planting to help direct bats away from the railway crossing and towards the culvert. See below.
44 (2015) / 6 (2014)	SMN-0680	6,900	Morfa Gronw Reen Culvert	Bat passes: 500-1500 average bat passes per survey visit. Species: – regional value to barbastelle bats (individuals – location 6); – regional value to Myotis, serotines, noctules, Leisler's and Nathusius'	Culvert along the realigned Morfa Gronw Reen. Box culvert. Internal dimensions: 1.8 x 1.8 x 72 m. Located in field immediately to the west of the static detector. Water Treatment Area (including reed bed) and tree planting to the north and tree planting and shrubs to the south of the new road would help to guide some bats towards the culvert. Culvert may be used by some:

Static detector location ref:	Culvert ref. Figure 2.6	Chainage	Name	Bat activity and value to foraging and commuting bats (as defined by Wray *et al*. 2010)	Description of crossing feature
				(location 6) bats (individuals); – county value to pipistrelles (large numbers); and – district value to brown long-eared bats (individuals – location 44).	– Daubenton's bats, if present (Boonman 2011; Limpens 2005); and – pipistrelle bats (Boonman 2011); however, Limpens et al. (2005) recommended tunnels 4-6 m in height x 4-6 m in width. Culvert less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – barbastelle bats (Limpens 2005; Highways Agency 2011; Bach et al. 2004; Brinkman et al. 2003); – noctules (Highways Agency 2011; Boonman 2011; Limpens 2005); – Leisler's bats (Abbott et al. 2012, 2012); – Nathusius' bats (Limpens 2005); – serotine bats (limpens 2005; Highways Agency 2008; Boonman 2011); and – brown long-eared (Limpens 2005).
	n/a	7,350	Lighthouse Road	Bat passes: 500-1500 average bat passes per survey visit. As above.	Lighthouse Road Bridge. Structure would span 28 m and 30 m, carrying a single carriageway 6.3 m wide. Potential for bats to continue to commute along the single lane road, or along the road bridge located one field to the east of the static detector location. Some potential to utilise the overbridge as a crossing point - Halcrow (unpublished 2008, cited in Highways Agency 2011) recorded bats flying along narrow bridges (with spans of <5 - 15m), including pipistrelles, Myotis and serotines; however, appears not to be a preferred crossing method (Bach *et al*. 2004) and, therefore, bats may prefer to cross the new motorway.
43 (2015); 7 (2014) rarer	SMN-0775	7,750	Old Diary Reen Culvert	Bat passes: >1500 average bat passes per survey visit and >2500 passes during one survey visit.	Box culvert along Old Dairy Reen. Internal dimensions: 1.8 x 1.8 x 62 m. Located at the location of the static detectors.

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
species				Species: – regional value to Myotis, serotines, Leisler's bats and noctules (individuals); – county value to pipistrelles (large numbers); – location 7, 2014: individual barbastelle bats (average 0.2-0.4 passes/night in August-September 2014); and – greater horseshoe bats (average 0.2 passes/night in October).	Culvert may be used by some: – Daubenton's bats, if present (Boonman 2011; Limpens 2005); – pipistrelle bats (Boonman 2011); however, Limpens et al. (2005) recommended tunnels 4-6 m in height x 4-6 m in width; and – greater horseshoe bats (Wray *et al.* 2005); although tunnels 4-6 m height and width are recommended over culverts (Highways Agency 2011). Culvert less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – barbastelle bats (Limpens 2005; Highways Agency 2011; Bach et al. 2004; Brinkman et al. 2003); – noctules (Highways Agency 2011; Boonman 2011; Limpens 2005); and – Leisler's bats (Abbott et al. 2012, 2012); and – serotine bats (limpens 2005; Highways Agency 2008; Boonman 2011).
42 (2015)	SMN-0800	7,975	Pont-y-Cwcw Culvert	Bat passes: >1500 average bat passes per survey visit and >2500 passes during one survey visit. Species: – regional value to Myotis, serotines, Leisler's bats, noctules and Nathusius' bats (individuals); – county value to pipistrelles (large numbers); and – district value to brown long-eared bats (individuals).	Culvert along realigned Pont-y-CwCw Reen. Box culvert. Internal dimensions: 1.8 x 1.8 x 59 m. Located at the point of the static detector location, where very high bat activity was recorded. Culvert may be used by some: – pipistrelle bats (Boonman 2011); however, Limpens et al. (2005) recommended tunnels 4-6 m in height x 4-6 m in width); and – Daubenton's bats, if present (Boonman 2011; Limpens 2005); Culvert less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered

Static detector location ref:	Culvert ref. Figure 2.6	Chainage	Name	Bat activity and value to foraging and commuting bats (as defined by Wray *et al*. 2010)	Description of crossing feature
					bats, Bechstein's bats (Limpens 2005); – noctules (Highways Agency 2011; Boonman 2011; Limpens 2005); – Nathusius' bats (Limpens 2005); and – Leisler's bats (Abbott et al. 2012, 2012).
8 (2014) rarer species location	SBR-0805	8,025	New Dairy Farm Overbridge	Species: – barbastelle bats (average 0.2 passes/night in September and October 2014).	Proposed overbridge carrying access over the new section of motorway. Structure would span 32.8 m and 32.2 m, carrying a single carriageway 5 m wide and a 2.5 m wide footpath. Approximately 200 m to the west of the static detector, i.e. opposite end of same field, which is bordered by hedgerows and/or watercourses. River Ebbw underbridge approximately 200 m to the east of the static detector, i.e. opposite end of the field, which is bordered by hedgerows and/or watercourses. Barbastelle's may follow bridges and other such structures, particularly associated with water (Highways Agency 2011).
	SBR-0850	8,500	River Ebbw Underbridge		
40 (2015)	n/a	11,300	n/a	Bat passes: >1500 average bat passes per survey visit. Species: – regional value to Myotis (small numbers); – regional value to noctules (individuals); and – county value to pipistrelles (large numbers).	Bat detector located adjacent to where the road bridge begins to lift above ground-level to cross the River Usk; therefore, open access beneath the bridge is maintained here, for bats to commute beneath road.
38 (2015)	n/a	11,650	Mammal crossing	Bat passes: >1500 average bat passes per survey visit. Species: – regional value to Myotis (small numbers); – regional value to serotines,	Tunnel 900 mm in diameter, 67.27 m in length. Located at point of high bat activity. Tree and scrub planting to the north and south of the new road would help to guide bats towards the mammal crossing. Additional potential bat commuting route to west – see 40. May be used by some:

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
				Leisler's bats, possible noctules and barbastelles (individuals); – district value to pipistrelles (large numbers); and – district value to brown long-eared bats (individuals).	– Daubenton's bats, if present (Boonman 2011 recorded Daubenton's bats using culverts at a height of 0.4 – 0.9 m); however, Limpens (2005) recommends culverts from 1 m height x 2 m width or tunnels 4-6 m height x width). Less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – pipistrelle bats (Limpens 2005); Boonman 2011; Highways Agency 2011); – serotines (Boonman 2011); – barbastelle bats (Limpens 2005; Highways Agency 2011; Bach et al. 2004; Brinkman et al. 2003); – Leisler's bats (Abbott et al. 2012, 2012); – noctules (Booman 2011; Limpens 2005); and – brown long-eared bats (Limpens 2005).
39 (2015)	n/a	11,550	n/a	Bat passes: 500-1500 average bat passes per survey visit. Species: – regional value to Myotis (small numbers); – regional value to serotine, possible Leisler's bats, noctules and barbastelles (individuals); – district value to pipistrelles (large numbers); and – district value to brown long-eared bats (individuals).	Mammal crossing (900 mm diameter) located along eastern boundary of same field where static detector located. See 38.
11 (2014) rarer species	n/a	12,750	Pye Corner mammal	Species: – lesser horseshoe bat passes during 5 night survey periods in April and	Mammal crossing 900 mm diameter. Located approximately 50 m to the east of the static detector. A cut-off ditch and rough grass embankment will provide some habitat

Static detector location ref:	Culvert ref. Figure 2.6	Chainage	Name	Bat activity and value to foraging and commuting bats (as defined by Wray *et al*. 2010)	Description of crossing feature
			crossing	October 2014 were between 7 and 5 respectively.	connectivity between the crossing and he detector location. May be used by some: – lesser horseshoe bats; however, Limpens (2005) recommends culverts of 1m height x 1 m width, and recommendations for tunnels are 2.5 m diameter (Highways Agency 2008) to 4-6 m diameter (Limpens 2005).
13 (2015)	SMN-1300	13,000	Julian's Reen Culvert	Bat passes: 250-500 average bat passes per survey visit; however, >2500 passes during one survey visit. Species: – regional value to Myotis, noctules, and possible serotines and/or Leislers (individuals); – county value to pipistrelles (large numbers); and – district value to brown long-eared bats (individuals).	Julian's Reen Culvert on Tatton Farm. Box culvert. Internal dimensions: 1.8 x 1.8 x 56 m. Located along field boundary approximately 200 m to south-west of detector. Tatton Farm Culvert along realigned unnamed waterway. Single span pre-cast box culvert section. Internal dimensions: 1.8 x 1.8 x 55 m. Located approximately 50 m to east of detector. Field Culvert along realigned unnamed waterway. Single span pre-cast box culvert section. Internal dimensions: 1.8 x 1.8 x 54 m. Located approximately 300 m to north-east of detector. Ditches to border both sides of the new road and areas of marshy grassland to the south of the new road could help to guide some bats towards the culverts. May be used by some: – Daubenton's bats, if present (Boonman 2011 recorded Daubenton's bats using culverts at a height of 0.4 – 0.9 m); however, Limpens (2005) recommends culverts from 1 m height x 2 m width or tunnels 4-6 m height x width); and – pipistrelle bats (Boonman 2011); however, Limpens et al. (2005) recommended tunnels 4-6 m in height x 4-6 m in width. Less likely to be used by some:
	SMN-1330	13,300	Tatton Farm Culvert		
	SMN-1350	13,525	Field Culvert		

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
					– other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – noctules (Highways Agency 2011; Boonman 2011; Limpens 2005); – Leisler's bats (Abbott et al. 2012, 2012); – serotine bats (limpens 2005; Highways Agency 2008; Boonman 2011); and – brown long-eared (Limpens 2005).
12, 14, 15 and 16 (2015)	See 13	13,000-13,550	See 13	Bat passes: 500-1500 average bat passes per survey visit. Species: – regional value to Myotis, serotines (location 16), (possible) Leisler's bats, noctules and Nathusius' bats (location 15) (individuals); – county value to pipistrelles (large numbers); and – district value to brown long-eared bats (excluding location 15) (individuals).	See 13
13 – 15 (2014) rarer species location. - 13 (2014).	SBR-1640	16,375	Steelworks Dedicated Reen Bridge	Species: – location 13, 3 lesser horseshoe bat passes during a five night survey in September 2014; – location 14, 1-2 lesser horseshoe bat passes during five night survey periods in May and October respectively; – location 15, 1 lesser horseshoe bat pass during a five night survey in April 2014; and – locations 13-14, average	Steelworks Dedicated Reen Bridge: Box culvert. Internal dimensions 4.2 x 4.0 x 54 m. Less than 300 m to the east of the detectors. Open grassland and watercourses will help to connect the detector locations to the reen bridge. Elver Pill Reen Culvert: on current alignment. Box culvert. Internal dimensions 1.8 x 1.8 x 61 m. Approximately 300 m to the west of the detectors. Open grassland and watercourses to connect the detector locations to the reen bridge. Realigned Middle Road Diversion Reen. Box culvert. Internal dimensions 4.2 x 2.1 x 56 m. Approximately 250 m to the west of the static detector site. Open and marshy/wet grassland, watercourses, and tree and shrub planting
-14 (2014).	SMN-1655	16,600	Elver Pill Reen Culvert		
-15 (2014).	SBR-1780	17,875	M4 Middle		

Static detector location ref:	Culvert ref. Figure 2.6	Chainage	Name	Bat activity and value to foraging and commuting bats (as defined by Wray *et al*. 2010)	Description of crossing feature
			Road Diversion Reen Bridge	passes/night of barbastelles was between 0.2 and 0.4 between April and September 2014.	between the static detector locations and reen bridge. Cock Street Reen Culvert on current alignment. Box culvert. Internal dimensions 1.8 x 1.8 x 60 m. Open and marshy/wet grassland, watercourses, and tree and shrub planting to connect the static detector locations and reen bridge. Culverts may be used by: – lesser horseshoe bats (Highways Agency 2008; Limpens 2005). Middle Road Diversion Reen culvert less likely to be used by: – barbastelle bats due to the width of the culvert (Bach et al. 2004; Brinkman et al. 2003 as cited in Highways Agency 2011).
	SMN-1850	18,475	Cock Street Reen Culvert		
8 (2015); 16 (2014) rarer species	SMN-1925	19,125	Petty Reen Culvert	Bat passes: 500-1500 average bat passes per survey visit; however, >2500 passes during one survey visit. Species: – regional value to Myotis, noctules, serotines, and Leisler's bats (individuals); – country value to pipistrelles (large numbers); – district value to brown long-eared bats (individuals); and – location 16 (2014), 1 - 18 lesser horseshoe bat passes recorded during five night survey periods between April and October 2014, of district value.	Box culvert along realigned Petty Reen. Internal dimensions: 1.8 x 1.8 x 60 m. Located two field boundaries approximately 150 m to the south-west of the static detector. Tree and scrub planting to the north and Water Treatment Area to south of the new road would help to guide some bats towards the culvert. Culvert may be used by: – lesser horseshoe bats (Limpens 2005); – pipistrelle bats (Boonman 2011); however, Limpens et al. (2005) recommended tunnels 4-6 m in height x 4-6 m in width; and – Daubenton's bats, if present (Boonman 2011 recorded Daubenton's bats using culverts at a height of 0.4 – 0.9 m); however, Limpens (2005) recommends culverts from 1 m height x 2 m width or tunnels 4-6 m height x width). Culvert less likely to be used by:

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
					– other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – noctules (Highways Agency 2011; Boonman 2011; Limpens 2005); – Leisler's bats (Abbott et al. 2012, 2012); – serotine bats (limpens 2005; Highways Agency 2008; Boonman 2011); and – brown long-eared (Limpens 2005).
10 (2015); 7, 9-10 (2015) rarer species	SMN-1925	19,100	Petty Reen Culvert	Bat passes: 500-1500 average bat passes per survey visit. Species: – regional value to noctules (small numbers); – regional value to Myotis, serotines, Leisler's and Nathusius' bats and barbastelles (individuals); – district value to common pipistrelles (small numbers); – district value to lesser horseshoe and brown long-eared bats (individuals); and – locations 7, 9-10 (2015), between 1 and14 lesser horseshoe bat passes/5 night survey between June and September 2015, of district value.	Box culvert along realigned Petty Reen. Internal dimensions: 1.8 x 1.8 x 60 m. Located less than 50 m to the east of detector 10 (2015). Tree and scrub planting to the north and Water Treatment Area to south of the new road would help to guide some bats towards the culvert. Culvert may be used by: – lesser horseshoe bats (Limpens 2005); – pipistrelle bats (Boonman 2011); however, Limpens et al. (2005) recommended tunnels 4-6 m in height x 4-6 m in width; and – Daubenton's bats, if present (Boonman 2011 recorded Daubenton's bats using culverts at a height of 0.4 – 0.9 m); however, Limpens (2005) recommends culverts from 1 m height x 2 m width or tunnels 4-6 m height x width). Culvert less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – noctules (Highways Agency 2011; Boonman 2011; Limpens 2005); – barbastelle bats (Highways Agency 2011; Limpens 2005);

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
					– Leisler's bats (Abbott et al. 2012, 2012); – brown long-eared (Limpens 2005); and – Nathusius's bats (Limpens 2005).
5 (2015) high levels of activity plus rarer species; 6 (2015) rarer species	n/a	19,800	Bareland Street Underbridge	Bat passes: >1500 average bat passes per survey visit and >2500 passes during one survey visit. Species: – regional value to Myotis, serotines, Leisler's and Nathusius' bats, noctules and barbastelles (individuals); – county value to pipistrelles (small numbers); – district value to brown long-eared and lesser horseshoe bats (individuals); – at location 6 (2015) between June and August 2015, between 2 and 5 passes of lesser horseshoe bats per five night survey period; and – at location 5 (2015) during September 2015, 1 lesser horseshoe pass during a five night survey.	Underbridge for diverted Bareland Street. 37.9 m long, clear span of 10.95 m (to accommodate 5.5 m wide carriageway and two 2.5 m wide verges), headroom of 7.5 m. Bats would be able to continue to cross the new motorway by commuting along the underbridge. Tree and shrub planting alongside embankment would help direct bats towards the underbridge.
4 (2015); 2-4 (2015) rarer species	See 5	19,900	Bareland Street Reen	Bat passes: 500-1500 average bat passes per survey visit. Species: – regional value to Myotis and noctules (small numbers); – regional value to Leisler's bats and possible serotines (individuals); – county value to pipistrelles (large	See 5.

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
				numbers); and – at location 2-4 (2015) during June and August surveys, 1 – 7 lesser horseshoe pass recorded during a five night survey periods.	
1 (2015) including rarer species; 17 (2014) rarer species	n/a	20,225	Green Moor Lane	Bat passes: 500-1500 average bat passes per survey visit. Species: – regional value to Myotis, serotines, Leisler's and Nathusius' bats and noctules (individuals); – county value to pipistrelles (large numbers); – district value to lesser horseshoe and brown long-eared bats (individuals); – at locations 1 (2015) 1-16 lesser horseshoe bat passes recorded during five night survey periods in June (16 passes) and August 2015 (1 pass); and – at locations 17 (2014) 1-5 lesser horseshoe bat passes recorded during five night survey periods between May and October 2014.	Green Moor Lane to be retained as an underpass to the new road. Therefore, bats could continue to commute along the road, beneath the new road.
32 (2015) high activity and rarer species	n/a	See 1	See 1	Bat passes: 500-1500 average bat passes per survey visit. Species: – regional value to Myotis and noctules (individuals); – county value to pipistrelles (large numbers);	See 1

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
				– lesser horseshoes recorded during five night survey periods in June – August 2015, with a maximum of 15 passes recorded in June 2015); district value to lesser horseshoes bats (individuals); and – district value to brown long-eared bats (individuals).	
33-36 (2015); 33, 35-37 (2015) rarer species; 18 (2014) rarer species	n/a n/a	n/a 20,850	Magor Road / B4245 Newport Road	Bat passes: 500-1500 average bat passes per survey visit. Species: – regional value to Myotis (individuals to small numbers (location 33)); – regional value to noctules (individual (locations 35, 36) to small numbers); – regional value to serotines (locations 33, 34, 36) (individuals); – regional value to and Leisler's bat (individuals); – regional value to Nathusius' bat (location 33) (individuals); – district (locations 33, 35) to county (location 34) value to pipistrelles (small to large (location 34, 36) numbers);	Magor Road to be stopped up from junction with A4810 Queensway. A new overbridge to be provided at Newport Road, which would be diverted offline to a new roundabout junction. Overbridge to span 36 m - 31.7 m, carrying a single carriageway 7.3 m wide with footpath and cycleways 2.5 m and 4.1 m wide. Culvert up to 900 mm diameter to be constructed at 20,880. Woodland planting to north and south of overbridge to help guide some bats to the overbridge and culvert. Some potential to utilise the overbridge as a crossing point - Halcrow (unpublished 2008, cited in Highways Agency 2011) recorded bats flying along narrow bridges (spans of <5 -15m), including pipistrelles, Myotis and serotines; however, appears not a preferred crossing method (Bach et al. 2004), bats may prefer to cross over the new motorway. Culvert may be used by some: – Daubenton's bats, if present (Boonman 2011 recorded Daubenton's bats using culverts 0.4 – 0.9 m high); however, Limpens (2005) recommends culverts 1 m height x 2 m width or tunnels 4-6 m height x width). Culvert less likely to be used by: – other Myotis species (e.g. Brandt's bats, whiskered bats, Bechstein's bats (Limpens 2005); – pipistrelle bats (Limpens 2005); Boonman 2011; Highways Agency 2011);

Static detector location ref:	Culvert ref. Figure 2.6	Chainage	Name	Bat activity and value to foraging and commuting bats (as defined by Wray *et al*. 2010)	Description of crossing feature
				– district value to brown long-eared bats (individuals); and – at locations 33, 34-37 (2015), 1-14 lesser horseshoe bat passes in five night survey periods between June and September 2015; at location 18, 5 passes in October 2014; district value to lesser horseshoe bats (individuals); and	– serotines (boonman 2011); – Leisler's bats (Abbott et al. 2012, 2012); – noctules (Booman 2011; Limpens 2005); and brown long-eared bats (Limpens 2005).
				– location 18 barbastelle bats activity between May and July 2014 was between 0.6 and 1.5 bat passes/visit.	
19 (2014), high activity and rarer species	SBR-2140	21,375	Mill Reen Culvert	Bat passes: >500 average bat passes per survey visit. Species: – regional value to noctules (small numbers); – regional value to barbastelle bats, Nathusius' bats and Myotis (individuals); – county value to pipistrelles (large numbers); – lesser horseshoe passes during five night survey periods between April and October 2014 from 1 to 55, of district value	Extension to existing culvert along Mill Reen. Existing structure is an in situ reinforced concrete arch roof structure. Extension would be similar in form and appearance. Clear span of 6 m, height of 4 m above the right of way and length of 135 m. Tree and shrub planting to the north and south of the new road would help guide bats towards the culvert. As an extension to an existing culvert, bats would not be diverted and it is considered that species could continue to use the culvert.

Static detector location ref:	**Culvert ref. Figure 2.6**	**Chainage**	**Name**	**Bat activity and value to foraging and commuting bats** (as defined by Wray *et al*. 2010)	**Description of crossing feature**
				(individuals); and – barbastelle passes/night during five night survey period in August average 0.2.	
20 (2014) rarer species	n/a	22,700	Rockfield Lane Underpass	Species: – 1-9 passes of lesser horseshoe bats during five night survey periods between May and September 2014.	Proposed underbridge carrying the new section of motorway and reclassified M4 over Rockfield Lane. To consist of a concrete box, internal dimensions 9.0 m x 6.81 m, with a length of 41.28 m, for a 5.5 m wide carriageway and two 1.75 m wide verges. Therefore, bats will continue to be able to use Rockfield Lane and embankment scrub and trees once established.

Risk of Injury and/or Fatality

10.8.403 Mammal exclusion fencing (as described in Chapter 2: Scheme Description) would be installed around the boundary of the new section of motorway and where necessary around additional construction areas. The fencing would help to guide some species of foraging and commuting bats towards box culverts and mammal crossings, thereby encouraging their use.

Construction Lighting

10.8.404 Lighting will act as a deterrent to some bat species, including some Myotis and Rhinolophus (Stone et al. 2009; Fure 2006), both of which have been recorded in the bat surveys (Appendices 10.7 and 10.23) and which prefer to forage in darkness (Rydell and Racey, 1995). Some Myotis species have been recorded turning away from light sources located at a distance of around 10-15 m (Kuijper *et al.* 2008). For some species, which partly rely on vision to forage and commute between areas, lighting can impair their ability to follow flight lines and for others, which emerge late in the evening, including brown long-eared bats (e.g. Eklöf 2003), low lighting levels are required before they will emerge to forage. Therefore, construction lighting could act as a barrier to foraging and commuting for some species and could result in the abandonment of roosts. However, lighting can attract some species of bat, including noctules and pipistrelles which have been recorded in the bat surveys (Appendices 10.7 and 10.23), due to their invertebrate prey being drawn to the lights. This attraction could make these bat species more vulnerable to predation.

10.8.405 As described in Chaper 3: Scheme Construction lighting would be provided as required during 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 during the night time. Such task lighting would be positioned at low level on posts and directed at the most frequently used areas of work.

10.8.406 Inward facing security lighting would be provided at construction compounds on a 24 hour basis.

10.8.407 A more detailed lighting strategy for the construction period would be developed to identify the type of lighting to be used and measures to be implemented to reduce light spill. The strategy would be agreed with the local planning authority and the regulator.

Pollution

10.8.408 Construction would result in the production of pollutants which could impact upon habitats of potential value to bats and the invertebrate prey of bats.

10.8.409 Therefore, as part of the Scheme, 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 3.2) with regard to the handling and storage of potentially hazardous liquids, response to spillages, provisions for surface water drainage (including interception of oil and sediment) and dust control.

10.8.410 The above mitigation measures would ensure that airborne and runoff pollutants would not present a significant risk to bats during construction.

Noise and Vibration

10.8.411 Noise and vibration generated during the construction of the Scheme has the potential to cause disturbance to bats in roosts close to the Scheme and to bats foraging and commuting in or across nearby habitat. However, bats, including lesser horseshoe bats, can be relatively tolerant of noise whilst roosting, particularly if the noise is relatively regular or not unexpected and bats can become accustomed to it.

10.8.412 Since working at night would be limited in frequency and extent, it is considered unlikely that foraging and commuting bats would be significantly affected by construction noise.

Monitoring

10.8.413 Monitoring would be carried out during construction to determine the use by bats of box culverts, mammal crossings, underpasses and overbridges. Results of these monitoring surveys would inform the need for consideration of revisions to the mitigation measures within the Scheme such as additional planting.

10.8.414 Monitoring surveys would be completed with regard to survey guidelines published by the Bat Conservation Trust (Collins, 2015) and as required by the European Protected Species Licence. The ECoW would be responsible for ensuring the appropriate undertaking of surveys and for reporting results to the Project Manager and to NRW.

Assessment of Potential Effects

10.8.415 Considering the likely displacement impact of construction, in particular as a result of habitat clearance and light spill, and the potential for bat injuries and fatalities during the removal of roosts, the magnitude of the impact of construction on bats (Regional (Medium) value) is assessed as Moderate Adverse leading to effects of Moderate significance primarily with regard to those species that do not commute across open spaces.

Assessment of Effects with Additional Mitigation

10.8.416 It is likely that there would be some changes in bat activity while crossing points are constructed (some of which such as reen culverts would be installed during the first 8 months of the works on the Caldicot Levels and the first 9 months on the Wentlooge Levels) and until bats locate these. Measures would be carried out in order to help bats locate these features, including locating them at or close to sites of high and very high bat activity, and the installation of mammal fencing and bat corridors.

10.8.417 Taking the above into account, in addition to other mitigation measures, primarily the use of sympathetic lighting, as well as the availability of alternative habitat in the immediately surrounding area, and recognising the uncertainty over the extent to which bats would use culverts and mammal crossings, the magnitude of the impact of construction with mitigation on bats remains as Moderate Adverse leading to effects of Moderate significance.

Breeding Birds

10.8.418 The main impacts related to the construction of the new section of motorway on birds would be disturbance and displacement. These effects arise from both visual and noise disturbance, and would extend beyond the construction boundary into habitat which may have otherwise been suitable for breeding birds. Given the ecology of breeding birds identified during the 2014 and 2015 studies, the possibility of any barrier effects as a result of construction is considered to be low. The potential effects on breeding birds during the operation of the new section of motorway are considered in Section 10.9.

10.8.419 Noise modelling data (Chapter 13: Noise and Vibration and Figure 13.3) indicates that current background noise levels in the vicinity of the Scheme, including the location of the bulk of Cetti's warbler records, is currently approximately 45-50 $dB(A)_{L10(18h)}$.

10.8.420 As explained in Chapter 13: Noise and Vibration, without any specific mitigation, the predicted noise level from plant and activities associated with the construction phase is estimated to be in the region of 68 to 74 dB at 50 m from a construction worksite, 60 to 66 dB at 100 m from a worksite, 50 to 56 dB at 250 m from a worksite and 43 to 49 dB at 500 m from a worksite.

10.8.421 Chapter 3: Noise and Vibration explains that within the expected variation of construction noise predictions, it is appropriate to approximate the distances for daytime works as: major impacts within approximately 45 m of a worksite; moderate impacts within approximately 115 m of a worksite; and minor impacts within approximately 180 m of a worksite. At some locations, more substantial construction works may be required, for example, where more major earthworks or piled foundations occur.

Assessment of Potential Effects

10.8.422 Although herring gull and lesser-black backed gull were reported in the study area, no named breeding species of the Severn Estuary SPA or Ramsar sites were recorded exhibiting breeding behaviour within and in the immediate vicinity of the construction boundary. Therefore construction would not result in disturbance to these named species. The predicted magnitude of impact is thus No change. The significance of effect on qualifying breeding species of European designated sites is therefore Neutral.

10.8.423 The potential for disturbance extends beyond the footprint of the construction works. Of the 44 species recorded breeding in 2014 and 2015, it is judged that Cetti's warbler is the highest value single species (National (High) value). Cetti's warbler is a songbird so is likely to be the subject of masking impacts through noise as well as visual disturbance. The impacts of noise disturbance of varying levels at different distances from birds is not well understood in this species. Populations of all other breeding birds using the study area have been classified as being of District (Low) value. These species would be more likely to be affected by visual disturbance, though effects through noise disturbance cannot be ruled out.

10.8.424 Due to the spatial and temporal scale of construction impacts, the predicted magnitude of impact of construction on breeding birds is Moderate Adverse. The significance of effect on Cetti's warbler (National (High) value) would therefore be

Moderate or Large. For barn owl (County (Medium) value) the significance would be Moderate. For all other species that use the study area during the breeding season (District (Low) value), the significance of effect would be Slight.

Assessment of Effects with Additional Mitigation

10.8.425 The additional mitigation that has been accounted for in this section is vegetation clearance outside the bird breeding season. Barn owl nest boxes would be provided in trees around the boundaries of the mitigation land at Green Moor (chainage 17900 to chainage 19100) in the same area as the potential barn owl nest but further from the construction area.

10.8.426 There is no change with respect to the breeding components of the Severn Estuary SPA or Ramsar sites. The magnitude would remain as No change and the significance of effects as Neutral.

10.8.427 For barn owl the provision of alternative nest sites would reduce the magnitude of the impacts of construction to Minor Adverse and the significance of effects to Slight. The magnitude of impacts for other breeding birds would remain as Moderate Adverse. Therefore, the significance of effect on Cetti's Warbler would remain as Moderate or Large.

10.8.428 For other breeding bird species identified in the study area, there would be no change to the significance of effect, remaining as Slight.

Wintering Birds

10.8.429 The main impact of the construction of the new section of motorway on wintering birds would be disturbance and displacement. In addition, there is the possibility of habitat fragmentation of the Rivers Ebbw and Usk up and downstream of the proposed crossing locations. Displacement and disturbance effects brought about by construction would exert influence beyond the construction area into habitats which may have otherwise been suitable for wintering birds.

10.8.430 Named wintering components of the Severn Estuary SPA/Ramsar site utilise areas of suitable habitat outside the boundary of the designated sites. The most important areas within the study area for wintering birds associated with the Severn Estuary SPA/Ramsar site are the River Ebbw and River Usk, of which the latter is designated as an SSSI and SAC. The assessment focuses on these areas.

10.8.431 Other wintering species recorded in the study area are currently considered to be relatively flexible in their selection of winter habitats.

10.8.432 During the wintering bird surveys, it was determined that for three named species the study area population is of National (High) value (redshank, gadwall and pintail), for three named species the study area population is of County (Medium) value (teal, pochard and shoveler), and for six named species the study area population is of District (Low) value (shelduck, wigeon, tufted duck, curlew, lapwing and mallard). In addition, an array of species that are considered to represent part of the Severn Estuary SPA/Ramsar assemblage were recorded within the study area. This assemblage within the study area is also of District (Low) value.

10.8.433 The locations of the river crossings are situated in areas that are already subject to relatively high degrees of anthropogenic activity and disturbance. Background noise in the vicinity of the proposed crossing at the River Usk (see Figure 13.3) is currently estimated to be 45-50 $dB(A)_{L10(18h)}$, rising to 50-55 $dB(A)_{L10(18h)}$ within 300 m upstream and falling to 40-45 $dB(A)_{L10(18h)}$ within 500-700 m downstream. On the River Ebbw, the current estimated background noise level at the site of the proposed crossing is 45-50 $dB(A)_{L10(18h)}$. Upstream the background noise level is the same. It falls to 45-50 $dB(A)_{L10(18h)}$ directly downstream of the proposed crossing.

10.8.434 The response of some of the species known to be present at the proposed crossings to visual and noise disturbance has been characterised by the Waterbird Disturbance Mitigation Toolkit (TIDE, 2013) from where the following information has been extracted. Mallard was used as a proxy for other duck species, given the paucity of information directly applicable to them i.e. gadwall, pintail, teal, pochard, shoveler, wigeon and tufted duck. Redshank was used as a proxy for other wading birds.

10.8.435 Redshanks are relatively tolerant to visual disturbance, and habituate to works rapidly. They are highly sensitive to noise disturbance. It is likely that visual disturbance would occur at distances within 100 m of the works. A noise of up to 70 db may be acceptable at the bird (100-105 db at source assuming birds are 100 m away), but caution is recommended at noise levels greater than 60db at the bird (92 db at source when birds are 100 m away) in disturbed areas.

10.8.436 Shelducks are sensitive to disturbance, but it should be noted that the species is generally subject to a high degree of habituation. Shelducks can be affected by visual disturbance up to 500 m from source, with a minimum approach distance of 150 m. For noise disturbance, noise levels of 115-120 db at source would create a high level of disturbance (assuming birds are 150 m away). This increases to 125-130 db at 500 m.

10.8.437 Curlew is a species of moderate disturbance sensitivity, with an approach distance of 120-550 m before flushing. At a bird distance of 100 m, a noise to produce a high disturbance response would need to be in the region of 107-112 db at source, increasing to 117-122 db at source at a bird distance of 300 m.

10.8.438 Mallards are relatively tolerant to disturbance, and habituate rapidly to activity. In disturbed areas such as the study area, mallard visual disturbance ranges between 25-300 m. A noise of up to 72 db at the bird (105-110 db at source if the bird is 50 m away) is acceptable, with caution recommended at 60 db (87-92 db at source if the bird is 50 m away).

Assessment of Potential Effects

10.8.439 Construction of the new section of motorway at the river crossings would result in a localised (judged to be approximately 300 m up and downstream based on the species present) visual displacement/disturbance effect, which would have the greatest influence on those birds that regularly use the habitat directly in and adjacent to the proposed crossing footprints. Further away from the Scheme footprint disturbance/displacement effects would reduce. Based on the results of the wintering bird surveys, the named component of the Severn Estuary SPA/Ramsar site that would be most abundant, and therefore most exposed to

this effect, is redshank. For this reason, the assessment is based on the parameters for this species described above in terms of disturbance.

10.8.440 As explained in Chapter 13: Noise and Vibration, without any specific mitigation, the predicted noise level from plant and activities associated with the construction phase is estimated to be in the region of 68 to 74 dB at 50 m from a construction worksite, 60 to 66 dB at 100 m from a worksite, 50 to 56 dB at 250 m from a worksite and 43 to 49 dB at 500 m from a worksite.

10.8.441 Chapter 13 Noise and Vibration explains that within the expected variation of construction noise predictions, it is appropriate to approximate the distances for daytime works as: major impacts within approximately 45 m of a worksite; moderate impacts within approximately 115 m of a worksite; and minor impacts within approximately 180 m of a worksite. At some locations, more substantial construction works may be required, for example, where more major earthworks or piled foundations occur.

10.8.442 Based on the information from the Waterbird Disturbance Mitigation Toolkit (TIDE, 2013), and the fact that these areas are already subject to relatively high levels of background noise, this may not result in a discernible effect, although disturbance may occur at times of highest noise levels, or individual noise events.

10.8.443 When assessing the potential impact of construction, the availability of alternative habitat for any birds that are disturbed and/or displaced on a longer term basis should also be considered. It has been reported that in recent years, the Severn Estuary SPA wader population has generally declined (Burton *et al*. 2010). A search of the literature found no reporting of habitat loss for wading birds, and nothing to suggest that three of the five conservation objectives underpinning the SPA relating to habitat (the extent and distribution of the habitats of the qualifying features, the structure and function of the habitats of the qualifying features and the supporting processes on which the habitats of the qualifying features rely) are not being met. It is therefore reasonable to assume that ample habitat to support the waders recorded in the study area exists within the SPA boundary, so alternative habitat for these birds is available beyond the area in which impacts of the new section of motorway are expected to have an influence.

10.8.444 Based on this information the magnitude of impact is judged to be Minor Adverse. Therefore, with respect to construction, the significance of effect for the wintering birds that are part of the Severn Estuary SPA/Ramsar site would be Slight or Moderate for species of National (High) value (redshank, gadwall and pintail), Slight for species of County (Medium) value (teal, pochard and shoveler), Neutral or Slight for species of District (Low) value (shelduck, wigeon, tufted duck, curlew, lapwing and mallard), and Neutral or Slight for the other species that make up part of the Severn Estuary SPA/Ramsar assemblage.

10.8.445 For other species recorded within the study area (District (Low) value), the magnitude of impact during construction is judged to be Minor Adverse. The significance of effect would therefore be Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.8.446 No additional mitigation is proposed and thus the magnitude of impact would remain as Minor Adverse. Therefore, with respect to construction, the significance of effect for the wintering birds that are part of the Severn Estuary SPA/Ramsar site would be Slight or Moderate for species of National (High)

value (redshank, gadwall and pintail), Slight for species of County (Medium) value (teal, pochard and shoveler), Neutral or Slight for species of District (Low) value (shelduck, wigeon, tufted duck, curlew, lapwing and mallard), and Neutral or Slight for the other species that make up part of the Severn Estuary SPA/Ramsar assemblage (District (Low) value).

10.8.447 For other species recorded within the study area (District (Low) value), the magnitude of impact during construction would be Minor Adverse. The significance of effect would therefore be Neutral or Slight.

Complementary Measures

10.8.448 As referred to in Section 10.3, the Complementary Measures which are proposed are described in Chapter 2 Scheme Description. The limited nature of the works proposed, which are entirely within the existing highway land, means that no significant ecological effects of construction are likely.

10.9 Assessment of Operational Effects

Proposed New Section of Motorway

10.9.1 In this section of this chapter the potential effects of operation of the new section of motorway on each of the Ecological Units are identified and assessed, first, as required in Wales by DMRB Volume 11 Section 2, Part 5 HA 205/08 (Highways Agency, 2008a), without mitigation, and then with mitigation in place. For the purposes of the assessment, as explained in Section 10.5, certain measures are considered to be an integral part of the Scheme and are thus included in the 'without mitigation' assessment.

10.9.2 Operational effects would be manifest throughout the life of the new section of motorway and thus are all long term impacts unless otherwise stated.

10.9.3 The effects of air quality on designated sites and habitats during the operation of the road have been considered in Section 10.6. The other impacts during operation which may affect ecological receptors include habitat severance/fragmentation, highway drainage/water pollution and effects of noise disturbance.

Designated Sites

European Statutory Designated Sites

10.9.4 The effects of land take for the permanent works and construction of the new section of motorway on European designated sites are assessed in Sections 10.7 and 10.8. In this section the effects of the operation of the new section of motorway on these sites are considered.

10.9.5 Since there would be no further physical incursions into the sites, there would be no operational effects on the designated sites *per se*. The magnitude of impact on internationally designated sites (International (Very high) value) would thus be No Change and the significance of effect would be Neutral.

10.9.6 In so far as there would be operational impacts on individual VERs which are features of the European Sites, these are assessed below. The extent to which this may or may not lead to effects on the European Sites is addressed in the

report of the Statement to inform an Appropriate Assessment (Welsh Government, 2016a). The relevant features are as follows.

River Usk SAC

- Migratory fish
- Otter

Severn Estuary European Marine Site (SAC, SPA and Ramsar Site)

- Migratory fish (river and sea lamprey, twaite shad, salmon, eel, sea trout and allis shad) and assemblage of fish species
- Internationally important populations of migratory and wintering bird species and waterfowl

Wye Valley and Forest of Dean Bat Sites SAC

- Lesser horseshoe and greater horseshoe bats

National Statutory Designated Sites

10.9.7 The effects of land take for the permanent works and construction of the new section of motorway on nationally designated sites are assessed in Sections 10.7 and 10.8. In this section the effects of the operation of the new section of motorway on these sites are considered. There would be no further physical incursions into the sites. However, as explained under Grazing Marsh later in this section, some sections of SSSIs to the north of the new section of motorway would be severed from the major parts of the designated sites to the south. These are as follows:

- From chainage 6000 and chainage 8400 an area of some 126 ha of grazing marsh would lie to the north of the new section of motorway. All of this land lies within the St Bride's SSSI.
- From chainage 13000 to chainage 13900 the major part of the grazing marsh of Tatton Farm (some 32 ha) within the Gwent Levels - Nash and Goldcliff SSSI would be to the north of the new section of motorway.
- From chainage 16900 to chainage 17500 an area of some 48.3 ha of grazing marsh at Green Moor would be to the north of the new section of motorway. This is partly within the Gwent Levels - Whitson SSSI and partly within the Gwent Levels - Redwick and Llandevenny SSSI.
- From chainage 17900 to chainage 20000 an area of grazing marsh of some 181 ha within the Gwent Levels-Redwick and Llandevenny SSSI would be to the north of the new section of motorway.

10.9.8 All of this land could continue to be managed as grazing marsh alongside the operation of the Scheme. The magnitude of impacts on nationally designated sites (National (High) value) is assessed as Negligible Adverse and the significance of effects as Slight. No additional mitigation is proposed.

10.9.9 The effects on the interest features of the SSSIs which occur in the vicinity of the new section of motorway and which could be affected are assessed under the individual VERs below. These are as follows.

River Usk (Lower Usk) SSSI

- Otter.
- Migratory fish (river and sea lamprey, twaite shad, salmon, eel, sea trout and allis shad) and assemblage of fish species.

Severn Estuary SSSI

- Internationally important populations of migratory and wintering bird species and waterfowl.
- Migratory fish (river and sea lamprey, twaite shad, salmon, eel, sea trout and allis shad) and assemblage of fish species.

Mwyngloddfa Mynydd-Bach SSSI

- Lesser horseshoe bat winter hibernation roost.
- Lesser horseshoe and greater horseshoe bats.

Wye Valley Lesser Horseshoe Bat SSSI

- Lesser horseshoe bat summer roosts.
- Lesser horseshoe and greater horseshoe bats.

Gwent Levels SSSIs

- Reen and ditch habitat (Eutrophic standing waters).
- Aquatic insects and other invertebrates.
- Shrill carder bee.

Newport Wetlands SSSI

- Internationally important populations of migratory and wintering bird species and waterfowl.

Non-statutory Designated Sites

10.9.10 The non-statutory designated sites in the vicinity of the new section of motorway are shown on Figure 10.3. The effects of land take for the permanent works and construction of the new section of motorway on non-statutory designated sites are assessed in Sections 10.7 and 10.8. In this section the effects of the operation of the new section of motorway on these sites are considered. The SINCs which are on or adjacent to the line of the new section of motorway are, from west to east, the Afon Ebbw River SINC, Marshall's SINC, Solutia Site SINC, Spencer Works 3 SINC, Bowkett Field, Barecroft SINC, Barecroft Fields SINC, Land at Barecroft Common SINC, Grange Road SINC, and Upper Grange Farm SINC.

10.9.11 In addition there are other SINCs within 1 km of the new section of motorway which could be subject to an increase in noise as a result of the operation of the new section of motorway. A number of these are already close to the existing M4, A48(M) or M48, or are located within urban areas, and it is unlikely that the operation of the new section of motorway would result in additional disturbance at these sites. However, there are a number which are not currently near any major roads. These are, from west to east, LG Duffryn Site 1 (South Lake Drive) SINC,

LG Duffryn Site 2 SINC, Alpha Steel Site SINC, Elver Pill Reen Grassland and Pond SINC, Greenmoor Pool SINC, Upper Cottage Pond SINC, Blue House Farm SINC and Blackwall Lane Field SINC.

10.9.12 Each of the SINCs which potentially would be affected is considered in turn.

10.9.13 LG Duffryn Site 1 (South Lake Drive) SINC. The features of interest are identified as a pond and *Phragmites* reedbed, and Cetti's warbler. The site is some 600 m north of the line of the new section of motorway and would not be affected by habitat severance/fragmentation or highway drainage/water pollution.

10.9.14 LG Duffryn Site 2 SINC. The features of this site are identified as a large area of neutral grassland adjacent to the Gwent Levels. The site is some 350 m north of the line of the new section of motorway and would not be affected by habitat severance/fragmentation or highway drainage/water pollution.

10.9.15 Afon Ebbw River SINC. The designated site in this section of the SINC is confined to the channel of the river itself. The new section of motorway would pass over the river on a viaduct. There would be no significant severance of the river habitat. There would be a highway drainage outfall on the east bank of the river. Drainage from the new section of motorway would discharge to the River Ebbw via an oil separator.

10.9.16 Marshall's SINC. The designated site largely comprises the saltmarsh on the eastern bank of the River Usk together with a large pond and areas of industrial land. The new section of motorway would cross the saltmarsh on the new bridge and continue eastwards on a viaduct. There would only be minor incursions into the SINC by the viaduct supports and there would be no significant severance of the saltmarsh habitat. There would be no discharge of highway drainage in the vicinity of the SINC.

10.9.17 Solutia Site SINC. The designated site is a series of improved and semi-improved grasslands with traditional ditches and ponds. The site supports a range of species including nesting birds such as Cetti's warbler, and invertebrates including hairy dragonfly. The new section of motorway would sever 6.03 ha of the SINC from the other 45.7 ha to the north of the road. Water Treatment Area 6 would be located at the eastern edge of the SINC north of the road and would discharge to the Lakes Reen to the east of the SINC. There would be no discharge to the SINC.

10.9.18 Alpha Steel Site SINC. The designated site is some 100 m to the south of the line of the new section of motorway, It is described as an area of former levels, scrub and other habitats but actually largely comprises a series of large sludge lagoons. The site description refers to a range of species including scarce moth species, birds such as Cetti's warbler, and plants including orchids. The site would not be affected by habitat severance/fragmentation or highway drainage/water pollution.

10.9.19 Spencer Works 3 SINC. As described in sections 10.7 and 10.8 this site, located in the Tata Lagoons area and designated for marshy grassland with wet drains, would be largely removed during the construction of the new section of motorway. Assuming that the area required for temporary construction use is restored following completion of the works, then this restored area, with the residual area of the SINC beyond, would adjoin the northern boundary of the

motorway. Beyond the loss of area, the site would not be affected by habitat severance/fragmentation or highway drainage/water pollution.

10.9.20 Elver Pill Reen Grassland and Pond SINC. This site is some 200 m south of the line of the new section of motorway. It is designated as a lagoon with mosaic of swamp and marshy and dry semi-improved neutral grassland, and supports Cetti's warbler. The site would not be affected by habitat severance/fragmentation or highway drainage/water pollution.

10.9.21 Greenmoor Pool SINC. The site is adjacent to the north west corner of the operational Tata Steelworks some 850 m north of the line of the new section of motorway, and is designated as formerly standing water which now supports reedswamp, which itself supports bird populations including Cetti's warbler. The site would not be affected by habitat severance/fragmentation or highway drainage/water pollution.

10.9.22 As explained in Section 10.4, Bowkett Field, Barecroft SINC; Barecroft Fields SINC; and the Land at Barecroft Common SINC in the Bareland Street area are adjoining fields of wet grassland. Other than the loss of the north west corners of Bowkett Field, Barecroft SINC and Barecroft Fields SINC, and a very small section of Land at Barecroft Common SINC as permanent land take, there would be no further habitat severance/fragmentation as a result of the operation of the new section of motorway. The sites would not be affected by highway drainage.

10.9.23 Upper Cottage Pond SINC. This pond site is some 600 m to the north of the line of the new section of motorway. The site would not be affected by habitat severance or highway drainage. The main interest of the site is the abundance of whorl grass *Catabrosa aquatica*.

10.9.24 Blue House Farm SINC. The site comprises a botanically interesting tall mosaic of damp and dry grassland habitats, enclosed by ditches and reens and is some 230 m to the south of the line of the new section of motorway. The site would not be affected by habitat severance or highway drainage.

10.9.25 Blackwall Lane Field SINC. This is a small, horse grazed meadow partly comprising species-rich grassland with occasional Hawthorn scrub establishing from an overgrown hedge with same mature/approaching veteran trees. The reen to the east supports a herb-rich community. It is some 900 m south of the line of the news section of motorway. The site would not be affected by habitat severance or highway drainage.

10.9.26 Grange Road SINC. This site comprises two fields of species-rich and semi-improved neutral grassland and as described in Section 10.7, the new section of motorway would skirt the northern edge with some loss of the designated site and there would be drainage outfall to the St Bride's Brook/Mill Reen. There would be no further habitat severance or effects of highway drainage during the operation of the new section of motorway.

10.9.27 Upper Grange Farm Field SINC. This is a species-rich grassy bank comprising some areas of rank, tussocky grass. As explained in Section 10.7, the new section of motorway would skirt the southern edge with some loss of the designated site. Works to St Bride's on the approach to the underbridge may also affect the western edge of the site. There would be no further habitat severance or effects of highway drainage during the operation of the site.

Assessment of Potential Effects

10.9.28 The operation of the new section of motorway would have little ongoing severance effect on SINCs and there would be no effects of highway drainage on the sites other than the drainage discharges to the River Ebbw SINC and to the St Bride's Brook within the Grange Road SINC. In the absence of mitigation other than that included in the Scheme, the magnitude of the operational impacts on SINCs (receptor of County (Medium) value) is assessed as Moderate Adverse and the significance of effects would be Moderate.

Assessment of Effects with Additional Mitigation

10.9.29 The proposals for mitigation for the loss of grazing marsh are set out in the SSSI Mitigation Strategy at Appendix 10.35 and referred to under Statutory Designated Sites above. To the extent that this would result in creation of new grassland areas and improved management of existing grasslands, this would also serve to mitigate for the operational impacts on SINCs.

10.9.30 Taking into account this additional mitigation, the magnitude of the operational impacts on SINCs is assessed as Minor Adverse and the significance of effects as Slight.

Nature Reserves

10.9.31 The nature reserves in the vicinity of the new section of motorway are the Newport Wetlands NNR and RSPB Nature Reserve (some 1.7km south of the new section of motorway), and the Magor Marsh (some 500 m south) and Great Traston Meadows (some 150 m south) Gwent Wildlife Trust Nature Reserves.

10.9.32 None of these nature reserves would be affected by habitat severance or highway drainage as a result of the operation of the new section of motorway. Unlike the other designated sites, nature reserves have a role as public amenities and the effects of the Scheme on this aspect of the nature reserves is considered in Chapter 15: Community and Private Assets.

10.9.33 Given their distance from the new section of motorway, adverse effects on the ecology of either Magor Marsh Nature Reserve or Newport Wetlands Nature Reserve as a result of the operation of the new section of motorway are unlikely (No change). There could be some disturbance from traffic in the north western part of Great Traston Meadows Nature Reserve (County (Medium) value). The magnitude of this impact is likely to be Minor Adverse and the significance of effects Slight. No additional mitigation is proposed.

Rivers (Usk and Ebbw)

10.9.34 The Rivers (Usk and Ebbw) Ecological Unit includes the following VERS.

- Rivers.
- Sub-tidal benthic habitat.
- Intertidal mudflats.
- Coastal saltmarsh.
- Migratory fish.

- Estuarine fish assemblage.

10.9.35 The overall operational impacts of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme. Then the impacts on each of the relevant VERs is assessed.

Effects of Highway Drainage

10.9.36 Pollutants and sediments associated with runoff from the River Usk Crossing have the potential to impact river, sub-tidal and intertidal habitats for the lifetime of the Scheme. However, the design of the Scheme drainage, as described in Chapter 16: Road Drainage and the Water Environment is intended to prevent any significant discharges of road runoff into the rivers. During operation, on the east side of the River Usk, drainage from the River Usk Crossing would outfall from an attenuation pond and a ditch across newly created saltmarsh to the River Usk. On the west side of the River Usk crossing, the highway drainage would discharge into the River Ebbw via an oil separator. An attenuation lagoon would not be required as the River Ebbw is tidal at this point, and is not impacted by additional fluvial flows.

10.9.37 Highway drainage discharges would be diluted within the Rivers Usk and Ebbw and dispersed away from the point of discharge. The presence of the discharge pipe at the top of the shore on the east of the River Usk, and the discharge of highway drainage, may lead to increased freshwater influence on the intertidal mudflats, particularly at low water, and therefore intermittent decreases in salinity. The *Hediste diversicolor* and *Macoma balthica* in littoral sandy mud biotope which dominates the intertidal mudflats is characteristic of variable salinity in estuaries and hence the key species regularly experience, and are therefore relatively tolerant to, large changes in salinity. Repeated exposure to reduced salinity influx may however compromise growth and reproduction of key species such as *M. balthica*. The outfalls may also lead to some gullying/sediment erosion within the intertidal mudflats as a result of discharges at low water. This could lead to a change to the sediment characteristics and therefore species present. Such effects would however be highly localised to the immediate vicinity of the outfalls.

10.9.38 Contaminants, including fuel and oils as well as particulate matter (i.e. silts) associated with road runoff have the potential to impact migratory fish, should these substances enter the River Usk or River Ebbw through the highway drainage system. The incorporation of an attenuation lagoon into the drainage system for discharges into the River Usk and oil separators for discharges into the River Ebbw would ensure that the water discharged to these rivers would contain minimal contaminants.

Potential for Pollution Events Resulting from Collisions/Other Traffic Incidents on the New Road

10.9.39 As explained in Chapter 16: Road Drainage and the Water Environment, the Drainage Strategy Report (Appendix 2.2) that would be implemented as part of the Scheme) has been designed to ensure the capture of any fuel or other spillages that may occur during the operation of the road (e.g. through a vehicle collision or other incident).

10.9.40 A collision or traffic incident on the River Usk Crossing would have the potential to result in pollution of the River Usk and River Ebbw and the associated coastal saltmarsh. Potential pollutants released onto the highway which could enter the drainage system could include diesel/fuel, chemicals as well as water contaminated by products used in the clean-up operations of traffic accidents, all of which would have adverse effects on intertidal mudflats.

10.9.41 The final design of the Scheme drainage is intended to prevent any significant discharges of road runoff or other materials into the rivers or other watercourses and is designed to ensure capture of any fuel or other spillages occurring during operation of the road.

Disturbance to Sensitive Species from Light

10.9.42 Artificial lighting has the potential to disorient migrating fish and to create a barrier to migration. This may be of particular relevance for the downstream migration of silver eel and salmonids which are known to occur primarily at night. Artificial night lighting may influence the normal foraging and shoaling behaviour of estuarine fish as well as affecting predator-prey interactions and reproduction (Nightingale *et al.*, 2006).

10.9.43 As described in Chapter 2: Scheme Description, lighting is proposed on the approaches to the Docks Way Junction (including the River Ebbw crossing) and over the full extent of the River Usk Crossing. The locations of lighting columns are shown on the General Arrangement Drawings at Figure 2.4. The use of LED luminaires is proposed and, as additional mitigation, measures would be adopted to minimise light spill through appropriate lighting design.

10.9.44 The area in the vicinity of the River Usk Crossing is industrial land and there will be a degree of existing light spill into the River Usk and River Ebbw although this is unlikely to extend across the full width of the channel at the crossing point. However it should be noted that the Newport Transporter Bridge, the Southern Distributor Road Bridge and the existing M4 bridge upstream of the proposed River Usk Crossing are all lit.

10.9.45 Measures would be taken as part of the Scheme to minimise light spill.

Rivers

10.9.46 The potential effects of highway drainage and pollution from accidents on the rivers Usk and Ebbw and associated habitats have been identified above.

Assessment of Potential Effects

10.9.47 The assessment of the operational impacts on the Rivers habitat (receptor of National (High) value – River Usk, and County (Medium) value-River Ebbw) takes into account highway drainage and the potential for pollution events, in the absence of mitigation, other than those measures included as part of the Scheme design including the protection afforded to the River Usk by the storage lagoon. The magnitude of impact is assessed as Negligible Adverse and the significance of effects as Slight for the River Usk, and the magnitude as Minor Adverse and the significance of effects Slight for the River Ebbw.

Assessment of Effects with Additional Mitigation

10.9.48 The incorporation of the drainage strategy as a key aspect of the Scheme design is considered to provide a comprehensive means by which to protect the Rivers habitat within the River Usk and River Ebbw from contaminants associated with the routine highway runoff and pollution events. These measures are sufficient to reduce the risk to the Rivers habitat and no additional mitigation measures are proposed.

10.9.49 The magnitude of the operational impacts on the Rivers habitat would therefore remain as Negligible Adverse and the significance as Slight for the River Usk, and the magnitude as Minor Adverse and the significance Slight for the River Ebbw.

Sub-tidal Benthic Habitat

10.9.50 The potential effects of highway drainage and pollution from accidents on the rivers Usk and Ebbw and associated habitats have been identified above.

Assessment of Potential Effects

10.9.51 The magnitude of the operational impacts on subtidal benthic habitats (receptor of County (Medium) value – River Ebbw; National (High) value – River Usk)) taking into account highway discharge and the potential for pollution events in the absence of mitigation, other than those measures included as part of the Scheme design including the protection afforded to the River Usk by the storage lagoon, is assessed as Negligible Adverse and the significance of effects as Neutral or Slight (River Ebbw) and Slight (River Usk).

Assessment of Effects with Additional Mitigation

10.9.52 The incorporation of the drainage strategy as a key aspect of the Scheme design is considered to provide a comprehensive means by which to protect subtidal benthic habitat within the River Usk and River Ebbw from contaminants associated with the routine highway runoff and pollution events and no additional mitigation measures are proposed.

10.9.53 The magnitude of the impact of highway discharge on subtidal benthic habitat therefore remains as Negligible Adverse and the significance of effects as Neutral or Slight (River Ebbw) and Slight (River Usk)..

Intertidal Mudflats

10.9.54 The potential effects of highway drainage and pollution from accidents on the rivers Usk and Ebbw and associated habitats have been identified above.

Assessment of Potential Effects

10.9.55 The assessment of the operational impacts on intertidal mudflats (receptor of County (Medium) value – River Ebbw or National (High) value – River Usk) takes into account highway discharge and the potential for pollution events in the absence of mitigation, other than those measures included as part of the Scheme design including the protection afforded to the River Usk by the storage lagoon. The magnitude of impact is assessed as Negligible Adverse and the significance of effects as Neutral or Slight (River Ebbw) or Slight (River Usk).

Assessment of Effects with Additional Mitigation

10.9.56 The incorporation of the drainage strategy as a key aspect of the Scheme design is sufficient to reduce the risk to intertidal mudflats and no additional mitigation measures are proposed.

10.9.57 The magnitude of the impact of highway discharge and pollution events on intertidal mudflats would therefore remain as Negligible and the significance of effects as Neutral or Slight (River Ebbw) or Slight (River Usk).

Coastal Saltmarsh

10.9.58 The potential effects of highway drainage and pollution from accidents on the rivers Usk and Ebbw and associated habitats have been identified above.

Assessment of Potential Effects

10.9.59 The magnitude of the operational impacts on coastal saltmarsh (receptor of County (Medium) value – River Ebbw or National (High) value – River Usk) taking account of highway discharge and potential pollution in the absence of mitigation, other than those measures included as part of the Scheme design including the protection afforded to the River Usk by the storage lagoon, is assessed as Negligible Adverse and the significance of effects as Neutral or Slight (River Ebbw) or Slight (River Usk).

Assessment of Effects with Additional Mitigation

10.9.60 The measures included within the drainage strategy for the Scheme provide a comprehensive means by which to protect coastal saltmarsh habitat within the River Usk and River Ebbw from contaminants associated with the routine highway runoff and potential pollution events during the operation of the road. These measures are deemed to be sufficient to reduce the risk to intertidal mudflats and, as such, no additional mitigation measures are proposed.

10.9.61 The magnitude of the impact of highway discharge on coastal saltmarsh would therefore remain as Negligible Adverse and the significance of effects as Neutral or Slight (River Ebbw) or Slight (River Usk).

Migratory Fish

10.9.62 The potential effects of highway drainage, pollution from accidents and light spillage on the rivers Usk and Ebbw and associated species have been identified above.

Assessment of Potential Effects

10.9.63 The magnitude of operational impacts on migratory fish (receptor of International (Very high) value) taking account of bridge lighting shining on the waters of the River Usk and River Ebbw causing behaviour/barrier effects, highway discharges and pollution events in the absence of mitigation (other than those measures included as part of the Scheme design, including the protection afforded to the River Usk by the lagoon) is assessed as Minor Adverse and the significance of effects as Moderate or Large.

Assessment of Effects with Additional Mitigation

10.9.64 The additional mitigation measures including the design and siting of lighting to minimise light spill into the River Usk and the River Ebbw, together with the measures included in the Scheme, would be sufficient to control to risk of light disturbance to migratory fish. The magnitude of the impacts on migratory fish (receptor of International (Very high) value) during operation would be Negligible Adverse and the significance of effects Slight.

Estuarine Fish Assemblage

10.9.65 The potential effects of highway drainage, pollution from accidents and light spillage on the rivers Usk and Ebbw and associated species have been identified above.

Assessment of Potential Effects

10.9.66 The magnitude of operational impacts on estuarine fish (receptor of National (High) value) taking account of lighting, highway discharges and pollution events in the absence of mitigation (other than those measures included as part of the Scheme design, including the protection afforded to the River Usk by the lagoon) is assessed as Minor Adverse and the significance of effects as Slight or Moderate.

Assessment of Effects with Additional Mitigation

10.9.67 The additional mitigation measures including the design and siting of lighting to minimise light spill into the River Usk and the River Ebbw, together with the measures included in the Scheme would be sufficient to control the risks to estuarine fish. The magnitude of the operational impacts on estuarine fish (receptor of National (High) value) during the operation of the road would be Negligible and the significance of effects Slight.

Reens, Ditches, Reedbeds and Ponds

10.9.68 The Reens, ditches, reedbeds and ponds Ecological Unit includes the following VERS.

- Eutrophic standing waters.
- Ponds.
- Reedbeds.
- Aquatic macrophytes.
- Otter.
- Water vole.
- Grass snake.
- Great crested newt and other amphibians.
- Freshwater fish assemblage.
- Freshwater invertebrates.

10.9.69 The overall effects of the operation of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme. Then the impacts on each of the relevant VERs is assessed.

Severance/Fragmentation of Habitats or Corridors

10.9.70 Reens along the new section of motorway would be culverted when the Scheme was operational. This would ensure that there was no hydrological fragmentation or severance of these features. Some field ditches would be infilled and not culverted. However, these features would be connected with the system through the creation of replacement field ditches that would then connect with the main reen system. Consequently, there would be no field ditches severed or fragmented once the Scheme was operational.

10.9.71 The lengths of the reen culverts (see the Drainage Strategy Report (Appendix 2.2) and the Reen Mitigation Strategy (Appendix 2.3) and Table 10.18) would result in the loss of light along them. The loss of light through the culverts would prevent the establishment of normal aquatic ecosystems within them.

10.9.72 Soomers *et al*. (2013) have shown that placing culverts in ditches increases seed capture probability therefore reducing the dispersal distances of seeds. Soomers *et al*. (2013) also indicated however that this effect is reduced as the width of the culvert increases. Bank roughness is also a factor in how far hydrochorous seeds (i.e. seeds that are dispersed by water) disperse along watercourses. Through the relatively wide culverts included in the Scheme design along these reens, roughness would be much reduced due to the lack of vegetation and smooth sided banks, which would allow seeds and, potentially turions (i.e. dormant vegetative buds) and tubers, to be transported unhindered through the culverts before being caught on existing vegetation beyond the culvert therefore enabling dispersion through these systems.

10.9.73 Both longitudinal connectivity (along the watercourse) and lateral connectivity (connection of the watercourse with wetlands and riparian habitats) are important for many aquatic organisms including invertebrates (Environment Agency, 2010a). The presence of the Scheme has the potential to result in freshwater habitat fragmentation and/or severance of wildlife corridors.

10.9.74 Although the culverting of reens would maintain the connectivity of these watercourses post-installation, longitudinal connectivity may be permanently affected due to the inability of macrophyte species to recolonise within the culverts due to reduced light levels and decreased substrate depth. Aquatic invertebrates that rely on the well-vegetated nature of these watercourses would therefore find it difficult to commute along these culverted sections, and this may affect the long term ability of the invertebrate community to sustain itself and colonise new areas.

10.9.75 Many aquatic invertebrates, including water beetles, Odonata and many water bugs, are able to fly and would therefore be more likely to recolonise severed or new aquatic habitats. Their ability to traverse the width of a motorway and locate these habitats is uncertain, although repopulation from habitats either side of the new section of motorway is likely.

10.9.76 The design of the culvert crossings has recognised the need to maintain habitat connectivity as far as practicable. As explained in the Buildability Report

(Appendix 3.1), concrete box culverts would be pre-cast and generally installed off-line before being connected to the existing reens to minimise disturbance to the reens. Culverts would be installed with the invert at least 150 mm below the existing reen bed level to allow a natural substrate bed to form and provide continuity with that of the existing reen. This would provide connectivity for benthic invertebrates that are not reliant upon macrophytes, although the likely lack of macrophytes within the shaded culverts would make it difficult for invertebrates that are directly or indirectly dependent upon macrophytes as food source or substrate to commute these distances.

10.9.77 Whilst there would be some permanent severance of aquatic habitats through the Scheme, through the creation of habitat within the Scheme and the reinstatement and creation of links between new and existing reens and ditches the impacts upon aquatic invertebrates would be mitigated as far as practicable.

10.9.78 No ponds would be severed or fragmented as part of the Scheme.

10.9.79 Fragmentation of habitat for aquatic macrophytes, aquatic invertebrates, water vole, otter, and fish are discussed separately later in this section.

10.9.80 The reedbeds to the west of Tata would be severed by the new section of motorway with an area of 1.81 ha left to the south of the new section of motorway. This area drains in a south to north direction and the functionality of the reedbed to the north of the route as a water treatment area for Tata would be maintained through the installation of a new water entry point to the north of the new section of motorway.

10.9.81 As shown on the EMP (Figure 2.6) the area of reedbed to the south of the new section of motorway would be retained as a reedbed.

Effects of Highway Drainage

10.9.82 Runoff from the new section of motorway would have the potential to result in contaminants entering reens and field ditches. Contaminants from road runoff could have detrimental effects on the ecosystems that are dependent on these systems. The drainage strategy for the Scheme has, however, been designed to manage the drainage of water from the new carriageway in terms of volume of water and pollution control and is described in the Drainage Strategy Report (Appendix 2.2).

10.9.83 Surface water runoff from the new section of motorway would be via grassed verge channels, water treatment areas and reedbeds, to facilitate the removal of particulates and chemical pollution prior to discharge to the main reens, as described in Chapter 16: Road Drainage and the Water Environment. The grassed channels have been designed to be dry during dry weather, thus enhancing their pollution removal capability; the channels would be lined with a geo-synthetic clay liner below 50 mm of topsoil to prevent pollutants seeping into the underlying ground. The slow flow of runoff water through grass would allow the filtration of sediment, with hydrocarbon residues and organic material retained and broken down in the vegetation and upper layers of soil.

10.9.84 Runoff from grassed channels would discharge into desilting catch pits before flowing into water treatment and attenuation areas/lagoons. Water from these lagoons would discharge into reens identified as receiving watercourses in the Drainage Strategy Report (Appendix 2.2), i.e. those with sufficient capacity to

accommodate the potential increase in flow. Discharges into reens would be above the summer penning level, with flap valves at the outfall pipes preventing water flowing back into the lagoons.

10.9.85 Discharge rates into the reen system would be within limits agreed with NRW.

10.9.86 No water would be discharged into any ponds within the vicinity of the Scheme.

10.9.87 As part of the design for the Scheme a total of 8.06 ha of new reedbed would be created within the water treatment areas. All road runoff would be passed through these features for final treatment before discharge into the reen system. There would be no release of waters into existing reedbeds.

10.9.88 As explained in Chapter 16: Road Drainage and the Water Environment, the proposed drainage system has been designed to cater for a 1 in 100 year storm event, plus a 30% allowance for climate change. Flood events greater in magnitude would result in runoff overflowing into the reen system. However, it is considered that a storm intensity of this magnitude would dilute any pollutants to tolerable levels.

10.9.89 European eel may colonise water treatment areas and attenuation lagoons once these area have naturalised. Eels are moderately tolerant of water pollution, as are other species of coarse fish within the reen network as described above, and therefore may be able to utilise these newly created habitats, especially given their ability to cross damp land to locate new habitats.

10.9.90 Measures adopted as part of the Scheme, in combination with existing water level management within the Gwent Levels, would ensure that there would be no significant impact upon the hydrological characteristics of watercourses and wetland areas. The creation of new reens, ditches, grassed channels and attenuation lagoons would provide increased water storage capability and minimise potential disruption to freshwater fish during operation of the Scheme.

Potential for Pollution Events Resulting from Collisions/Other Traffic Incidents on the New Road

10.9.91 There is the potential for a wide range of pollutants to be released following collisions or other road traffic incidents on the new section of motorway. These pollutants include hydrocarbon fuels from vehicles, metals, battery acids, polycyclic aromatic hydrocarbons (PAH), containerised chemicals, pesticides, detergents, firefighting substances and others. The volume of pollutants from road traffic incidents would generally be relatively low, although the toxicity of a pollutant may be very high. However, the likelihood of such an event occurring is considered to be low.

10.9.92 Pollution Prevention Guidance (PPG)22: Dealing with Spills (Environment Agency, 2011) advises that it is preferable where possible to contain pollutant spillages on the highway; however this would not be possible in all cases, and dilution of some pollutants followed by their runoff into the water treatment system, including those most hazardous to health and the environment, may be required. Where pollutants cannot be contained at the source of the incident by best practice containment techniques such as sand bags, bunding/booms, absorption or *in situ* treatment/neutralisation, they would runoff into the drainage system of grassed channels, water treatment areas and attenuation lagoons.

These areas provide additional opportunities for the removal or treatment of pollutants before discharge into the reen network.

10.9.93 As explained in Chapter 16: Road Drainage and the Water Enviroenment, each water treatment area has been designed to ensure that it provides sufficient treatment capacity to ensure the discharge would meet DMRB requirements and regulatory requirements for the protection of the Gwent Levels SSSIs, most notably with respect to heavy metals, organic contaminants associated fuels, oils and hydrocarbon combustion and major ions principally associated with de-icing. The water quality risk assessment have included both routine runoff and risks of spillage.

Salt Accumulation from De-icing Operations

10.9.94 Salt would be used in the winter months for de-icing of the carriageway, and there is the potential for runoff of saline water from the motorway, initially into grassed channels and the water treatment and attenuation system other than in a greater than 1 in 100 year flood event. Rock salt used for de-icing must comply with BS3247 and be stored according to PPG10, according to which "*the use of salt on highways is unlikely to lead to levels in the water environment that could affect aquatic life*". Application rates specified in Highways Agency guidelines (Highways Agency, 2009b) would be followed.

10.9.95 Mitigation within the proposed drainage strategy would accommodate runoff from the carriageway, including saline water following the application of salt for de-icing. Initially road runoff would flow into and along grassed channels before entering the water treatment and attenuation system. While runoff may be initially highly saline, dilution would occur rapidly and by the time saline runoff enters attenuation lagoons, salt concentrations are likely to be very low. There would be further dilution within the attenuation lagoons and through water treatment reedbeds.

10.9.96 As explained in Chapter 16: Drainage and the Water Environment, short term episodic breaches of chloride concentrations may occur during severe winters where thaws after freezing conditions can release high loads of dissolved road salt to the water treatment areas. Under such extreme conditions, dilution from the thawing of snow and ice within reen catchments is likely to promote dilution of in-channel concentrations to render such discharges negligible, taking into account their localised nature and short duration.

10.9.97 Some invertebrates are more tolerant of brackish conditions resulting from increased salt levels than others; for example both the great silver water beetle and *Hydaticus transversalis* are intolerant of saline conditions and even intermittent increases in salinity can result in a decline in species-richness of the habitat (Palmer *et al*., 2013).

10.9.98 The reens and ditches of the Gwent Levels are generally by freshwater, although those closest to the Severn Estuary or tidal reaches of the Rivers Usk and Ebbw may receive small amounts of saltwater by spray or high tide conditions. Nevertheless, these would not be classified as brackish according to the data presented in Chapter 16: Drainage and the Water Environment.

10.9.99 With the application of Highways Agency guidelines, proposed surface water runoff mitigation strategies, including water treatment and attenuation, the salt

concentration of water discharging into the reen network is not likely to be sufficiently high to cause adverse effects on aquatic invertebrates.

Lighting

10.9.100 The new section of motorway would only be lit at junctions and their approaches (including the River Ebbw Underbridge) and at the River Usk Crossing. Otherwise the motorway across the Gwent Levels would be unlit. As part of the additional mitigation the lighting would be designed to minimise light spill outside the motorway carriageway. In particular care would be taken to avoid lighting of the approaches to and the entrances of culverts and mammal crossings beneath the road and nearby habitats, including watercourses/waterbodies (including river corridors), water treatment areas, and woodland and scrub (new and existing).

10.9.101 Artificial lighting disturb freshwater fish species, many of which seek darker areas as a predator avoidance technique, or are naturally nocturnal and therefore prefer low light conditions.

10.9.102 Following recolonisation of newly created reens and field ditches after the construction phase it is likely that there would be sufficient macrophyte cover to provide shelter for fish species from the low levels of light spillage that may occur in the vicinity of the junctions with the new section of motorway.

Potential Ecological Benefits of New Landscape Provision and Management

10.9.103 Designed into the Scheme are measures to create new reens and field ditches. Details of the location and construction of new reens and ditches are provided in Chapter 2: Scheme Description and the Reen Mitigation Strategy (Appendix 2.3). The total length of replacement reens (2657 m) and field ditches (9771 m) would be slightly greater than the length of the reens (2568 m) and field ditches (9136 m) to be infilled or culverted. New watercourses would reflect the structure and characteristics of existing reens and ditches to which they would be connected.

10.9.104 New reens would be constructed to provide connectivity with existing reens, and mitigate for the infilling or culverting of reens where this cannot be avoided. New reens have been designed to reflect the structure of existing reens, and would be excavated to a depth of 2.0 m with 1 in 1 side slopes and a 0.7 m berm, resulting in a width of approximately 5.7 m at the surface. This would allow the new reens to recolonise with similar flora and fauna to that found in the existing reens.

10.9.105 Newly created ditches would be 2.5 m wide and 1 m deep with 1 in 1 side slopes, and would be positioned with their base level above that of the main reens.

10.9.106 New reens would recolonise with similar flora and fauna to that found in the existing reens. Recolonisation would be achieved by natural processes and also, as part of the additional mitigation, through the inoculation of new reens and field ditches to with the plant material from reens and field ditches scheduled for filling and from routine NRW reen maintenance, subject to NRW agreement.

10.9.107 The newly created reens and field ditches would be managed by NRW in the long term.

10.9.108 As set out in Chapter 2: Scheme Description, the new water treatment areas would include 15 attenuation ponds covering a total area of some 9.4 ha and 16 reedbeds with a total area of 8.06 ha.

10.9.109 As part of the operational phase of the Scheme, water treatment areas including reedbeds, and culverts would be maintained so as to ensure their continued effectiveness. In addition, new and replacement habitats (including replacement reens and ditches, woodland and scrub planting, which form part of the Scheme would be managed by the South Wales Trunk Road Agent.

10.9.110 As part of the additional mitigation, habitat within the SSSI Mitigation Areas would be managed in accordance with an SSSI Mitigation Areas Management Plan in order to ensure successful establishment of habitats and long term maximum benefit to biodiversity. The management plans would include responsibilities, financing and monitoring and reporting requirements.

10.9.111 Given that new reens and field ditches would be similar in character to those in the existing network, colonisation with freshwater fish species should be rapid, in conjunction with the development of the community of macrophytes and associated fauna. These newly created watercourses would provide suitable additional habitat for all of the fish species present within the existing system.

10.9.112 In addition, European eel may colonise the new attenuation lagoons. Eels are relatively flexible in their habitat requirements and inhabit a wide range of still and flowing waters. Levels of pollutants, for example from highway runoff, may be a deciding factor in the suitability of these waterbodies for eel and other fish species. Eels are able to cross damp land in the event that water conditions become unsuitable, and would be likely to find their way to other watercourses in the reen network.

10.9.113 The features of the proposed highway drainage system including grassed channels, water treatment areas (including reedbeds) and attenuation lagoons, would provide additional habitat for aquatic invertebrates. The character of these habitats would not necessarily reflect that of the existing reens and ditches, and the ability of invertebrates to colonise these areas would depend upon the resulting water quality and other factors such as desiccation. However, these habitats would provide the opportunity for a different range of aquatic plants to colonise, and in turn support a wider diversity of aquatic invertebrates.

10.9.114 Attenuation lagoons would provide further additional habitat for aquatic invertebrates dependent upon pollutant levels and the tolerance of these invertebrate taxa. The attenuation lagoons, due to their close proximity to receiving reens, would be colonised by aquatic invertebrates with mobile adult stages including Odonata, water beetles and Dipteran flies, with other invertebrates transferred by natural means, for example on the legs and plumage of waterfowl.

Eutrophic Standing Waters

Assessment of Potential Effects

10.9.115 The magnitude of the operational impact of the new section of motorway on eutrophic standing waters (receptor of National (High) value) taking into account habitat severance, changes to reen and field ditch levels, highway drainage, potential pollution events and use of de-icing salt, in the absence of mitigation other than the measures included in the Scheme, is assessed as Minor Adverse and the significance of effects as Slight or Moderate.

Assessment of Effects with Additional Mitigation

10.9.116 The magnitude of the operational impact of the new section of motorway on eutrophic standing waters (receptor of National (High) value) taking account of additional mitigation including minimising light spill outside the motorway carriageways, introduction of plant material from existing reens and field ditches into the new reens and field ditches, and the measures included in the SSSI Mitigation Strategy (Appendix 10.35) is assessed as Negligible Adverse and the significance of effects as Slight.

Ponds

Assessment of Potential Effects

10.9.117 The magnitude of the operational impact of the new section of motorway on ponds (receptor of County (Medium) value) taking into account habitat severance, highway drainage, potential pollution events and use of de-icing salt is assessed as Negligible Adverse and the significance of effects as Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.9.118 No additional mitigation is proposed with respect to ponds and so the magnitude of the operational impact of the new section of motorway would remain as Negligible Adverse and the significance of effects as Neutral or Slight.

Reedbeds

Assessment of Potential Effects

10.9.119 The magnitude of the operational impact of the new section of motorway on reedbeds (receptor of County (Medium) value) taking into account habitat severance, highway drainage, potential pollution events and use of de-icing salt is assessed as Minor Adverse and the significance of effects as Slight.

Assessment of Effects with Additional Mitigation

10.9.120 No additional mitigation is proposed for reedbeds and so the assessment of the magnitude of operational impacts remains as Minor Adverse and the significance of effects as Slight.

Aquatic Macrophytes

Assessment of Potential Effects

10.9.121 The magnitude of the operational impact of the new section of motorway on the assemblage of aquatic macrophytes (receptor of National (High) value) in the absence of mitigation (other than measures included in the Scheme) taking into account habitat severance, changes to reen and field ditch levels, highway drainage, potential pollution events and use of de-icing salt is assessed as Minor Adverse and the significance of effects as Slight or Moderate.

Assessment of Effects with Additional Mitigation

10.9.122 The magnitude of the operational impact of the new section of motorway on the assemblage of aquatic macrophytes (receptor of National (High) value) taking into account additional mitigation comprising minimising light spill outside the motorway carriageways, introduction of plant material from existing reens and field ditches into the new reens and field ditches, and the measures included in the SSSI Mitigation Strategy (Appendix 10.35), is assessed as Negligible Adverse and the significance of effects as Slight.

Otter

10.9.123 Otters readily use culverts and, therefore, the provision of culverts along retained reens, as described in the Reen Mitigation Strategy (Appendix 2.3), would enable the continued movement of otters across the new road, which would help prevent fragmentation of the local otter population, and would help ensure otters are able to access feeding and resting sites.

10.9.124 In addition, as described in the Reen Mitigation Strategy (Appendix 2.3), 2657 m of new reens (mitigating the infilling or culverting of 2568 m of reens) and 9771 m of new or replacement ditches (mitigating the loss of 9136 m of ditches) would be provided so as to connect to retained culverted reens. When established, the network of watercourses would enable otters to utilise aquatic habitat corridors for movement across the landscape throughout the operational phase.

10.9.125 As part of the mitigation for the Scheme, in order to prevent injuries or fatalities on the new road, mammal exclusion fencing suitable for otters would be installed along the boundaries of the full operational length of the new section of motorway within areas of suitable habitat. The mammal fencing would exclude water treatment areas and their associated tree and scrub planting, so as to enable foraging and resting otters to benefit from this additional habitat.

10.9.126 As part of the additional mitigation the fencing would be installed so as to lead otters up to entrances to culverts, dry underpasses and mammal crossings, as described in DMRB Volume 10, Section 4, Part 4 (Highways Agency, 1999).

10.9.127 Fencing would be installed under the supervision of an appropriately experienced person so as to ensure there would be no gaps along the fence line that otters could push through and gain access to the new road, e.g. where the fencing abuts features such as hedges, stiles or fences.

10.9.128 No holts have been located to date; however, an area of scrub located to the east of the River Ebbw and north of the new section of motorway has previously been identified as a holt site and is of potential value for resting otters. Due to the extent and location of this habitat, the new road is not considered to be of concern with regard to noise or vibration disturbance, should otters chose to use the area during the operational phase.

10.9.129 In the long term, once established and well developed, woodland planting (approximately 103 ha, replacing 49.8 ha) and scrub planting (7.06 ha) would be of potential value to resting otters, particularly where associated with watercourses.

Assessment of Potential Effects

10.9.130 The magnitude of the operational impact of the new section of motorway on otters (receptor of National (High) value) taking into account the installation of mammal exclusion fencing around the boundaries of the operational route of the new road, and measures to limit the potential for and likely impact of operational pollutants (runoff, ground leachate and light spill) which are included in the Scheme is assessed as Major Adverse and the significance of effects Large or Very Large, largely due to the lack of measures to enable otters to cross the line of the new road.

Assessment of Effects with Additional Mitigation

10.9.131 The magnitude of the operational impact of the new section of motorway on otter taking into account additional mitigation measures, in particular the provision of mammal crossings, and 900 mm mammal tunnels at all culverted reens, is assessed as Minor Adverse and the significance of effects Slight or Moderate.

Water Vole

10.9.132 The provision of reen culverts and mammal crossings would help to enable some movement of water voles across the new road, which in turn would help to prevent fragmentation of the local water vole populations in the long term.

10.9.133 In addition, as described above, the mitigation would include 2657 m of new reens and 9771 m of new or replacement ditches that would connect to retained culverted reens, in order to enable water voles to utilise aquatic habitat corridors for movement across the landscape throughout the operational phase, whilst also enabling them to benefit from the increased habitat available.

Assessment of Potential Effects

10.9.134 The magnitude of the operational impact of the new section of motorway on water vole (receptor of County (Medium) value) taking into account measures included as part of the Scheme, in particular measures to limit the potential for and likely impact of operational pollutants (airborne, runoff and light spill) and the maintenance of drainage features including new reens and water treatment areas, is assessed as Moderate Adverse and the significance of effects as Moderate primarily due to the lack of additional habitat.

Assessment of Effects with Additional Mitigation

10.9.135 Taking into account additional mitigation measures, in particular the long term management and maintenance of additional habitats of potential value to water voles within the SSSI Mitigation Areas (Appendix 10.35), the long-term monitoring of displaced and/or translocated populations and the management of mink, the likely magnitude of impact on water voles is assessed as Minor Adverse and the significance of effects as Slight.

Grass Snake

10.9.136 The maintenance of specially designed reen culverts and mammal crossings would help to enable some movement of grass snakes across the new section of motorway, which in turn would prevent fragmentation of the local population in the long term.

10.9.137 In addition, as described in the operational impact assessment for otters above, the Reen Mitigation Strategy (Appendix 2.3) would include 2657 m of replacement reens and 9771 m of replacement ditches that would connect to retained culverted reens, which would enable grass snakes to utilise aquatic habitat corridors for movement across the landscape throughout the operational phase, whilst also enabling them to benefit from the increased habitat available. The SSSI Mitigation Strategy (Appendix 10.35) would also provide habitat suitable for grass snake.

Assessment of Potential Effects

10.9.138 The magnitude of the operational impact of the new section of motorway on grass snake (receptor of County (Medium) value) taking into account measures included as part of the Scheme, in particular measures to limit the potential for and likely impact of operational pollutants (airborne, runoff and light spill) and the maintenance of drainage features including culverts and water treatment areas, is assessed as Moderate Adverse and the significance of effects as Moderate primarily due to the lack of additional habitat.

Assessment of Effects with Additional Mitigation

10.9.139 Taking into account additional mitigation measures, in particular the long term management and maintenance of additional habitats of potential value to grass snakes, including the additional reens and watercourses, and grassland habitats within the SSSI Mitigation Areas (Appendix 10.35), the likely magnitude of impacts of operation with mitigation on grass snake is assessed as Minor Adverse and the significance of effects as Slight.

Great Crested Newt and Other Amphibians

10.9.140 The maintenance of specially designed reen culverts and mammal crossings would help to enable some movement of great crested newts and other amphibians across the new section of motorway, which in turn would help to prevent fragmentation of the local populations in the long term.

10.9.141 In addition, as described above, the Reen Mitigation Strategy (Appendix 2.3) would include the maintenance of 2657 m of new reens and 9771 m of new ditches that would connect to retained culverted reens, in order to enable amphibians to utilise aquatic habitat corridors for movement across the landscape throughout the operational phase, whilst also enabling them to benefit from the increased habitat available.

10.9.142 The maintenance of the road drainage and treatment system to ensure that the quality of runoff to the reen system is maintained is important to mitigate effects on great crested newt and other amphibians.

Assessment of Potential Effects

10.9.143 The magnitude of the operational impacts of the new section of motorway on great crested newt (receptor of County (Medium) value) taking into account measures included as part of the Scheme, in particular measures to limit the potential for and likely impact of operational pollutants (airborne, runoff and light spill) and the maintenance of drainage features including culverts, new reens and

ditches and water treatment areas, is assessed as Minor Adverse and the significance of effects as Slight.

10.9.144 The magnitude of the operational impacts on other amphibians (District (Low) value) would be Minor Adverse and the significance of effects Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.9.145 No additional mitigation measures are proposed for great crested newt and thus the likely magnitude of impact of operation with mitigation on great crested newt would remain as Minor Adverse and the significance of effects as Slight.

10.9.146 The magnitude of the operational impacts on other amphibians (District (Low) value) would remain as Minor Adverse and the significance of effects Neutral or Slight.

Freshwater Fish Assemblage

10.9.147 Longitudinal connectivity along watercourses is important for freshwater fish (Environment Agency,, 2010a). There is the potential for freshwater habitat fragmentation and/or severance of wildlife corridors as a result of the new section of motorway intersecting a number of existing reens and field ditches of the drainage system within the Gwent Levels SSSIs. Details of reens which would be affected and associated new culverts are provided in Chapter 2: Scheme Description and the Reen Mitigation Strategy (Appendix 2.3).

10.9.148 The effects of habitat fragmentation upon freshwater fish in the reen network would be minimal.

10.9.149 While there may be some delay between the creation of these additional habitats and their maturation into fully developed components of the reen network, recovery is expected to be reasonably rapid and they would provide habitat consistent with that of the existing watercourses.

Assessment of Potential Effects

10.9.150 The magnitude of the operational impact of the new section of motorway on freshwater fish (receptor of County (Medium) value) taking into account the impact of severance/fragmentation of habitats or corridors, culverting of reens, replacement of reens and ditches, motorway lighting, highway drainage, use of de-icing salt, potential pollution events, and new landscape provision and management in the absence of mitigation (other than those measures included as part of the Scheme design) is assessed as Negligible Adverse and the significance of effects as Neutral or Slight.

10.9.151 For European eel (International (Very high) value) the magnitude of the operational impact is also assessed as Negligible Adverse and the significance of effects as Slight.

Assessment of Effects with Additional Mitigation

10.9.152 The measures which are part of the Scheme include culverting of reens beneath the new section of motorway re-connecting these watercourses. The lack of macrophytes in these culverted sections would not affect the ability of fish to disperse through them. Furthermore, new reens and ditches would be

constructed and connected to the existing reen network, with the total length of replacement reens and ditches greater than that to be lost.

10.9.153 These measures are considered to be sufficient to reduce the impacts to freshwater fish from habitat severance/fragmentation and, as such, no additional mitigation measures are proposed. The magnitude of the operational impacts on freshwater fish with designed-in mitigation would therefore remain as Negligible Adverse and the significance of effects as Neutral or Slight.

10.9.154 For European eel the magnitude of impacts would remain as Negligible Adverse and the significance of effects as Slight

Freshwater Invertebrates

Assessment of Potential Effects

10.9.155 The magnitude of the operational impact of the new section of motorway on aquatic invertebrates (receptor of National (High) value) in the absence of mitigation (other than those measures included as part of the Scheme design) taking into account severance/fragmentation of habitats or corridors, culverting of reens, replacement of reens and ditches, motorway lighting, highway drainage, use of de-icing salt, potential pollution events, and new landscape provision and management is assessed as Minor Adverse and the significance of effects as Slight or Moderate.

Assessment of Effects with Additional Mitigation

10.9.156 As described above for freshwater fish, the culverting of reens beneath the new section of motorway would re-connect these watercourses during the operation of the road. The lack of macrophytes in these culverted sections may affect the ability of aquatic invertebrates to disperse through them due to the dependence of many of these species on macrophytes for food, shelter etc. This may affect the long term ability of invertebrates to colonise new areas of the network. Aquatic invertebrates with terrestrial or airborne adults may however be able to traverse these culverts and the motorway to colonise new watercourses.

10.9.157 New reens and ditches would be constructed and connected to the existing reen network, with the total length of replacement reens and ditches slightly longer than those to be lost. Through the creation of new habitats and enhancement of existing habitats as part of the Scheme design the adverse impacts upon invertebrate populations can be minimised. The additional mitigation measures including the relocation of macrophyte material from infilled reens or annual weed clearance would further reduce the impacts to aquatic invertebrates.

10.9.158 The magnitude of the impact on freshwater invertebrates with the additional mitigation measures implemented would be Negligible Adverse and the significance of effects Slight.

Grazing Marsh

10.9.159 The Grazing marsh Ecological Unit includes the following VERS.

- Coastal and floodplain grazing marsh.
- Shrill carder bee.

- Wet grassland plants.

10.9.160 The overall impact of construction of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme and then the additional mitigation proposed. Then the impacts on each of the relevant VERs is assessed.

Severance/Fragmentation of Habitats or Corridors

10.9.161 So far as practicable the line of the new section of motorway skirts the northern edge of the grazing marsh habitats of the Gwent Levels. However, there are sections of the route where substantial areas of grazing marsh would be to the north of the new motorway.

10.9.162 Between chainage 6000 and chainage 8400 an area of some 126 ha of grazing marsh would lie to the north of the new section of motorway. All of this land lies within the St Bride's SSSI as referred to in Section 10.7. A substantial section of this area (some 88.6 ha) is already to the north of the Swansea to London main railway line. However the new motorway would further fragment the habitat in this area. Since the area to the north of the new section of motorway would be substantial it would remain viable for management for grazing.

10.9.163 Between chainage 11500 and chainage 12300 an area of some 45.66 ha of grazing marsh would lie to the north of the new section of motorway. This comprises the northern part of the Solutia Site SINC as referred to in Section 10.7. As explained in Chapter 15: Community and Private Assets this land is managed by Solutia under contract and one field is tenanted. A small section of this land (5.03 ha) would be isolated to the south of the new section of motorway but since the major part would remain in one block future management should not be significantly compromised.

10.9.164 From chainage 13000 to chainage 13900 the major part of the grazing marsh of Tatton Farm (some 32.13 ha) within the Gwent Levels - Nash and Goldcliff SSSI would be to the north of the new section of motorway. This land is owned by the Welsh Government and farmed under tenancies. As explained in Section 10.7 some of this land is one of the areas proposed for ecological enhancement as part of the SSSI Mitigation Strategy (Appendix 10.35).

10.9.165 From chainage 16900 to chainage 17500 an area of some 48.3 ha of grazing marsh at Green Moor would be to the north of the new section of motorway. This is partly within the Gwent Levels - Whitson SSSI and partly within the Gwent Levels - Redwick and Llandevenny SSSI. The major part of this land is within the Tata Steel site. There would be no significant change to the management of this land.

10.9.166 From chainage 17900 to chainage 20000 an area of some 181 ha of grazing marsh within the Gwent Levels-Redwick and Llandevenny SSSI would be to the north of the new section of motorway. However, this area already lies to the north of the A4810 road and the Euro Park Industrial Estate and partly to the north of the main railway line and the new motorway would make no material difference to the management of this land.

10.9.167 The effects of habitat severance on the aquatic macrophytes associated with the reens and ditches of the Levels have been assessed earlier in this section. As explained in Section 10.4, in addition to these aquatic species, a number of

notable wet grassland species were recorded in the NVC surveys carried out along the route of the new section of motorway in 2014 and 2015.

10.9.168 As explained in Section 10.4, the bumblebee survey carried out for the Scheme in 2015 focussed on shrill carder bee and on the Brown-banded carder bee. The great majority of the populations of both species occurred on or south of the route of the new section of motorway. Although they were found across the whole of the survey area, records were noticeably clumped in areas of floral diversity and abundance. Ungrazed open areas such as the Tata Steel land seem to be important in providing a greater diversity of floral resources. Hedgerows and reens were important where pasture was improved or semi-improved. As well as across the Levels, both these bee species were also found in areas of industrial land at Newport Docks and within the Tata Steel site. As explained in Section 10.4, the shrill carder bee was once widespread in the southern UK but is now restricted to small areas of the South and East of England, and South Wales. The population in the Gwent Levels is one of seven remaining populations in the UK.

10.9.169 Scarce bumblebees (including shrill carder bee) tend to develop meta-populations, which are groups of small but linked populations using patches of suitable habitat scattered across the landscape. Natural cycles of local extinction are balanced by re-colonisation from nearby sites, allowing their survival across the landscape. Some nationally important meta-populations of Shrill and Brown-banded carder bees rely heavily on landscapes containing brownfield areas alongside coastal grazing marsh and semi-natural grasslands as is the case in the area of the Scheme.

10.9.170 Scarce bumblebees (including shrill carder bee) ideally require in the region of 10-20 km² of habitat mosaics which include large, dense stands of forage. If sites become more isolated, it is more difficult for suitable habitat to be colonised, with progressive local extinctions leading to their declines across the landscape and the potential loss of entire meta-populations.

10.9.171 The Scheme has been designed to avoid severance of the Gwent Levels grazing marshes so far as practicable, however it would result in a degree of severance, in particular in that it would separate the major part of the brownfield land at the Tata Steel site from the grazing marshes to the south. At Newport Docks, both the new section of motorway itself and also the new access road to Docks Way would result in severance of bumblebee habitat.

10.9.172 As explained in Section 10.7, to the extent that there was loss of habitat for shrill carder bee, this would be mitigated by establishment of species rich-grassland as part of the landscape proposals for the Scheme. A significant element of this grassland would be established on the south facing linear embankment of the new section of motorway across the Gwent Levels.

10.9.173 West of the River Ebbw, there would be extensive areas of species-rich grasslands along the south-facing embankments along some 2 km of the Scheme, together with the bunds of the new water treatment areas.

10.9.174 The Scheme would thus provide corridors of habitat of value for bumblebees, including shrill carder bee, together with individual areas of suitable foraging habitat. To the extent that the new road did result in habitat severance, this could well influence the day to day foraging behaviour of the bees and result in bees

tending to forage either north or south of the new road. However, the road is unlikely to totally isolate bee populations and so would not be likely to prevent exchange of individuals between sites.

Mortality as a Result of Traffic Collisions

10.9.175 It is likely that there would be some mortality of bees as a result of traffic on the new section of motorway. This would be very difficult to quantify. However there would be hard shoulders providing a buffer between the vegetated verges and the carriageway, and it is notable that there are considerable efforts to promote the improvement of road verges for invertebrates by increasing their value as foraging habitat. This suggests that mortality as a result of traffic is not a significant factor.

Disturbance to Sensitive Species from Light

10.9.176 As they are active by day, bumblebees are not sensitive to road lighting.

Effects of Highway Drainage

10.9.177 The effects of highway drainage on grazing marsh would be largely a function of the effects on the reens and ditches which are an important component of the grazing marsh habitat. This is assessed earlier in this section.

Potential for Pollution Events

10.9.178 As for highway drainage, the effects of pollution events on grazing marsh would be largely a function of the effects on the reens and ditches which are an important component of the grazing marsh habitat. This is assessed earlier in this section.

Long Term Management and Maintenance

10.9.179 The major part of the grazing marshes of the Gwent Levels would lie in continuous areas of land to the west of the River Ebbw and east of the River Usk and would not be affected in any material way by the presence of the new section of motorway. As explained earlier in this section, some areas of grazing marsh would lie to the north of the new section of motorway.

10.9.180 The two important factors in the management of the grazing marsh habitat are the management of the reen system, including the control of penning levels, and vegetation management carried out by NRW, and the grazing management and maintenance of field ditches carried out by those farming the land.

10.9.181 NRW would be able to continue to manage the drainage of the grazing marsh north and south of the new section of motorway although there would be changes to the access arrangements. Whilst some areas of grazing marsh would lie to the north of the road and thus separated from the major part to the south, as explained under habitat severance above, this should not significantly affect the management of the land.

10.9.182 The management of other land at Newport Docks and Tata Steel would not be affected by the new section of motorway.

10.9.183 The management of the new areas of species-rich grassland created as part of

the Scheme would be the responsibility of the South Wales Trunk Road Agent.

Coastal and Floodplain Grazing Marsh

Assessment of Potential Effects

10.9.184 The magnitude of the impact of the operational new section of motorway on grazing marsh (National (High) value) taking into account habitat severance, and long term management and maintenance, and that provisions would be made for NRW to management the drainage regime, would be Minor Adverse and the significance of effects Slight or Moderate.

Assessment of Effects with Additional Mitigation

10.9.185 Taking into account the implementation of the SSSI Mitigation Strategy (Appendix 10.35) which would provide ecological enhancement of existing areas of grazing marsh and conversion of arable land to grazing marsh, the magnitude of the operational impacts on grazing marsh (National (High) value) would be Negligible Adverse (and in the longer term potentially Minor Beneficial) and the significance of effects Slight.

Shrill Carder Bee

Assessment of Potential Effects

10.9.186 The assessment of the effects of the operational new section of motorway on shrill carder bee (National (High) value) takes account of habitat severance, traffic mortality, and long term management and maintenance, and the mitigation measures included in the Scheme and shown on the EMP (Figure 2.6), and the ongoing management of the new species-rich grasslands as part of the Scheme, and NRW's management of the drainage system of the grazing marsh. The magnitude of impacts is assessed as Minor Adverse leading to effects of Slight or Moderate significance.

Assessment of Effects with Additional Mitigation

10.9.187 The magnitude of the impacts on shrill carder bee (National (High) value) taking into account the additional extensive creation of suitable habitat which would result from implementation of the SSSI Mitigation Strategy and which would provide additional foraging areas suitable for the species would be Negligible Adverse and the significance of effects Slight.

Wet Grassland Plants

Assessment of Potential Effects

10.9.188 The magnitude of the impacts of the operational new section of motorway on notable wet grassland species (County (Medium) value) as a result of habitat severance, and the effects of long term management and maintenance, including NRW's future management of the drainage of the land, would be Minor Adverse and the significance of effects Slight.

Assessment of Effects with Additional Mitigation

10.9.189 Taking into account the implementation of the SSSI Mitigation Strategy (Appendix 10.35), which would provide ecological enhancement of existing areas of grazing marsh and conversion of arable land to grazing marsh, and thus provide suitable habitat for wet grassland plants (County (Medium) value) the magnitude of the effects of the operation of the new section of motorway would be Negligible Adverse and the significance of effects Neutral or Slight (with the potential for Minor Beneficial impact).

Farmland

10.9.190 The Farmland Ecological Unit includes the following VERS.

- Lowland mixed deciduous woodland (including) Wet woodland).
- Hedgerows.
- Lowland meadow.
- Dormouse.
- Badger.
- Hedgehog.

10.9.191 The overall impacts of the operation of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme and then the additional mitigation proposed. Then the impacts on each of the relevant VERs is assessed.

Severance/Fragmentation of Habitats or Corridors

10.9.192 As explained in Section 10.4, areas of woodland are relatively infrequent in the area of the new section of motorway, typically comprising small, discrete units of broadleaved semi-natural woodland and broadleaved plantation woodland within a farmed landscape. In the areas where most woodlands occur, around the Castleton Interchange in the west and the Magor junction in the east, the existing M4, A48M and M48 already result in a degree of severance in the landscape. The new junctions would increase this severance by introducing new carriageways and widening the overall corridor affected by the roads. As well as increasing the degree of separation between woodlands on either side of the new road, the new plantations which would be established as part of the landscape and ecological mitigation of the Scheme would themselves be separated from one another by roads.

10.9.193 This severance is an inevitable consequence of the Scheme, particularly at the Castleton Interchange where, so far as practicable, means for woodland species such as dormouse and badger to cross the roads by means of mammal tunnels would be provided as shown on the EMP (Figure 2.6). The effects on these species are considered later in this section.

10.9.194 However, although there would be severance of habitats across the Scheme, the new plantings would themselves provide corridors for movement of wildlife through the countryside along sections of the line of the new section of motorway, and in so far as they connect with other corridors such as hedgerows and tree belts, into the wider countryside. It is evident from the distribution of dormice in

the vicinity of the Scheme that the roadside planting along the existing M4 north of Castleton form an important habitat and linear corridor for the species.

10.9.195 The Scheme also includes substantial blocks of new woodland planting in the borrow pit areas at Berryhill Farm (16.8 ha) in the west, and to the north east of Undy (9.59 ha) at the east of the new section of motorway. These woodlands would be substantial areas of continuous woodland habitat, significantly larger than any other individual existing woodlands in the vicinity of the new section of motorway.

Translocations

10.9.196 As part of the mitigation strategy for the operational phase of the Scheme, the long term management of the off-site dormouse receptor site(s) and dormouse population would be carried out in accordance with the requirements of the European Protected Species Licence for dormouse.

10.9.197 Should dormice be returned to the area surrounding the new section of motorway (i.e. to suitable areas of sufficiently established and matured woodland and scrub planting), these habitats would also be managed in accordance with the requirements of the dormouse licence.

10.9.198 Responsibilities for carrying out long term management would be detailed in the dormouse licence method statement and/or management plan. Management of land within the highway boundary would be the responsibility of the South Wales Trunk Road Agent. The method statement would include reporting and monitoring requirements. As for the construction phase, these would include annual monitoring of populations and reporting of findings to the Project Manager and NRW.

10.9.199 Post-construction monitoring of badgers would include surveys of artificial setts in accordance with any NRW badger licence. Surveys would be carried out in order to confirm use of setts and inform the potential need for additional mitigation or alterations to the setts.

10.9.200 In the long term, once established and developed sufficiently, woodland and scrub planting in relatively isolated and unlit areas would provide suitable locations for new badger setts.

Noise

10.9.201 Due to the fact that dormice currently inhabit plantation woodlands and scrub along the embankments of the existing M4 (Appendix 10.9 and 10.26 and Figure 10.8), it is not expected that noise from the operational phase of the new section of motorway would have significant effects on dormice in the area. Similarly badger setts are often located close to operational roads and railways and operational noise is unlikely to significantly affect badgers.

Wildlife Fencing

10.9.202 In order to prevent injury or fatality on the new road, mammal exclusion fencing suitable for badgers, as described in DMRB Volume 10, Section 4 Part 2 (Highways Agency, 2001) and as shown on the EMP (Figure 2.6) would be installed around the operational boundary of the new road. Mammal fencing

would exclude water treatment areas with associated areas of tree and scrub planting, so as to provide additional habitat of potential value to badgers.

10.9.203 Mammal fencing would be installed under the supervision of an appropriately experienced person so as to ensure there were no gaps along the fence that badgers could push through and gain access to the new road.

10.9.204 The mammal fencing would also help prevent hedgehog road injuries and fatalities, and would help to guide hedgehogs to box culverts with adjacent 900 mm mammal tunnels, and other mammal crossings in order to help minimise disruption of movement.

Wildlife Movement

10.9.205 In the long term, dormice from immediately surrounding areas could move into areas of established and sufficiently developed replacement and new planting, or dormice could be translocated back to these areas from off-site receptor sites, in accordance with the requirements of the dormouse licence.

10.9.206 Dormice are highly arboreal and prefer to move above ground level. They will occasionally travel across open ground (Bright *et al*. 2006). However they would be highly unlikely to cross the extensive open expanse of the carriageways of the new section of motorway. They would be more likely to cross the road by means of the mammal crossings and new box culverts with mammal crossings shown on the EMP (Figure 2.6), thereby helping to enable movement across the new section of motorway and minimising the potential impacts on the movement of individuals. The locations of these crossing points have been selected so as to coincide with dormouse habitat (as well as habitat of value to other protected species).

10.9.207 The box culverts with adjacent 900 mm mammal tunnels, and other dry mammal crossings, would provide crossing points across the new road in order to help minimise the long term potential to disrupt badger movement which, in turn, could affect breeding success and long term viability of populations. The mammal fencing would be aligned so as to direct badgers into box culverts and mammal crossings.

10.9.208 Post-construction/operational mitigation would include monitoring of badger activity in order to confirm effectiveness of the mammal fencing in excluding badgers from the new road and directing them towards crossing points and to ensure any repairs could be undertaken as soon as practicable. Monitoring would be carried out and in accordance with any NRW badger licence.

Operational Lighting

10.9.209 As described in Chapter 2: Scheme Description, lighting is proposed at the following locations.

- On the approaches to and throughout the Castleton Interchange.
- On the approaches to the Docks Way Junction and over the full extent of the River Usk Crossing.
- 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.

- On the approaches to and throughout the Magor Interchange.

10.9.210 Where present, operational lighting would be directed towards the new road and away from adjacent habitats, including areas of woodland and scrub, of value to dormice in the surrounding area and to any previously translocated dormice that might be returned to the area and to minimise the potential for disturbance of badgers and hedgehog.

Long Term Management and Maintenance

10.9.211 Management and maintenance of the new planting would be the responsibility of the Contractor for the first 5 years after the completion of the new section of motorway. Subsequent management would be the responsibility of the South Wales Trunk Road Agent and would become part of the organisation's programme for management of the trunk road estate. As explained in Section 10.4, the Welsh Government's Trunk Road Estate BAP includes a Habitat Action Plan for Woodlands and Planted Native Trees and Shrubs. The objectives of the plan include:

- maintain and enhance the existing woodland within the soft estate; and
- maximise biodiversity within woodlands.

10.9.212 The management of the new woodlands would take account of these objectives. As the planting matures, after the initial establishment phase when the main inputs would be to replace failed plants, there would be requirements for thinning to allow space for sound growth of the trees. Decisions would have to be made about the desired structure of the mature woodlands.

10.9.213 Replacement and additional habitat of potential value to badgers (including woodland and scrub planting, and grassland creation) would be monitored during the five year establishment period so as to assess the success of establishment and inform ongoing management requirements. To the extent that it would be desirable to manage at least some of the new woodlands for dormouse, areas of rotational coppice would be beneficial to ensure continued availability of hazel and other food species, and to provide the dense understorey which dormice prefer.

10.9.214 Woodlands outside the new section of motorway would continue to be managed and maintained by the landowners.

10.9.215 As explained in Section 10.4, hedgerows typically border the fields along the route of the new section of motorway (within the Gwent Levels section often adjacent to the reen or ditch forming the field boundary). As shown on the EMP (Figure 2.6) the landscape proposals include some 3.6 km of new hedgerows. As explained in Section 10.7 the Scheme would result in the loss of a total of some 35.8 km of hedgerows. However, the woodland and screen planting at Castleton and Magor at either end of the route would provide habitats of greater biodiversity value. NRW do not favour hedgerow planting within the Gwent Levels SSSIs. This is because hedgerows along the field boundaries can result in overgrowth/shading of the reens and field ditches with adverse effects on aquatic macrophytes and invertebrates which are the important features of the SSSIs.

10.9.216 As explained in Section 10.4, the Trunk Road Estate BAP includes a habitat action plan for boundary features which include hedgerows. One of the actions of the plan is to:

- raise awareness of those involved in design, construction and maintenance processes of the ecological importance of boundary features of all types, and provide detailed advice to management contractors.

10.9.217 Management of hedgerows outside the new section of motorway would remain the responsibility of the adjoining landowners. Management of the new highway boundary hedgerows, after the initial five years maintenance by the Contractor, would be the responsibility of the South Wales Trunk Road Agent.

10.9.218 The management of the SSSI mitigation areas, as described in the SSSI Mitigation Strategy (Appendix 10.35), may involve removal of hedgerows where these are shading reens or ditches and inhibiting the growth of aquatic vegetation.

10.9.219 As explained in Section 10.5, the landscape proposals described in Chapter 9: Landscape and Visual Effects and shown on the EMP (Figure 2.6) includes some 26.1 ha of species-rich grassland.

10.9.220 The total area of all grassland (excluding amenity grassland) included in the EMP (Figure 2.6) is some 117 ha. As explained in the section above relating to coastal grazing marsh, the SSSI mitigation proposals would also result in the creation of additional grassland and improvement in the biodiversity value of existing grassland.

10.9.221 The Trunk Roads Estate BAP includes a Lowland Meadows Habitat Action Plan. The objective of this Action Plan is to conserve and enhance the conservation of lowland meadow habitat within road verges, some of the actions being to:

- protect, maintain and enhance the conservation value of the lowland meadow habitats within the soft estate;
- raise awareness of those involved in the design, construction and maintenance of roads of the conservation value of these lowland meadow habitats and to provide detailed information on how to promote these habitats; and
- improve suitable areas which do not currently support valuable grassland habitats such as a lowland meadow habitat.

10.9.222 Following the establishment period, the responsibility for ensuring the long term management of new and replacement habitats located within the operational boundary of the new road, including water treatment areas, would be that of the South Wales Trunk Road Agent. Subject to agreement, NRW would undertake management of the new watercourses within the Gwent Levels.

10.9.223 The long term management of the SSSI Mitigation Areas would also be the responsibility of the South Wales Trunk Road Agent but in practice is likely to be undertaken by local farmers and would be subject to management plans which would be agreed with NRW following the principles set out in the SSSI Mitigation Strategy (Appendix 10.35). The Strategy would include details relating to responsibilities, financing, monitoring and reporting.

10.9.224 All other habitats (replacement and additional) located outside the operational boundary of the new section of motorway would be returned to landowners.

Lowland Mixed Deciduous Woodland (Including Wet Woodland)

Assessment of Potential Effects

10.9.225 The magnitude of the likely impact on Lowland mixed deciduous woodland as a result of severance, taking into into account the severance already caused by the existing roads and the planting included in the Scheme which is shown on the EMP (Figure 2.6) and described in Chapter 9: Landscape and Visual Effects, and differentiating between plantation (District (Low) value) and semi-natural woodland (County (Medium) value) would be:

- Plantation woodland: Minor Adverse leading to effects of Neutral or Slight significance, and in the long term, as new woodland planting matures, potentially Moderate Beneficial leading to effects of Slight significance.
- Semi-natural woodland: Minor Adverse leading to effects of Slight significance.

Assessment of Effects with Additional Mitigation

10.9.226 No additional mitigation is proposed and so the magnitude of the impact on Lowland mixed deciduous woodland as a result of severance remains as:

- Plantation woodland: Minor Adverse leading to effects of Neutral or Slight significance, and in the long term, as new woodland planting matures, potentially Moderate Beneficial leading to effects of Slight significance.
- Semi-natural woodland: Minor Adverse leading to effects of Slight significance.

10.9.227 The effects of woodland management, assuming this takes into account the objectives of the Trunk Road BAP habitat action plan for Woodlands and Native Trees and Shrubs, would be Beneficial.

10.9.228 If the management plans for the woodlands make specific provision for important woodland species, such as, for example, dormouse and bats, then the Beneficial effects of management would be enhanced.

Hedgerows

Assessment of Potential Effects

10.9.229 The effects of loss of hedgerows have been assessed under land take and construction impacts in Sections 10.7 and 10.8 above. The magnitude of the impacts of the operational new section of motorway on hedgerows (receptor of County (Medium) value) would be Negligible Adverse leading to effects of Neutral or Slight significance.

Assessment of Effects with Additional Mitigation

10.9.230 Assuming that the SSSI Mitigation Strategy (Appendix 10.35) is implemented, then management of the Scheme may result in removal of additional hedgerows.

10.9.231 The effects of hedgerow management, assuming this takes into account the objectives of the Trunk Road Estate BAP habitat action plan for Boundary Features, would be Beneficial.

10.9.232 Overall the magnitude of the impacts of the operational new section of motorway on hedgerows (receptor of County (Medium) value) would remain as Negligible Adverse leading to effects of Neutral or Slight significance.

Lowland Meadow

Assessment of Potential Effects

10.9.233 The effects of loss of Lowland meadow have been assessed under land take and construction impacts in Sections 10.7 and 10.8 above. The magnitude of the impacts of the operational new section of motorway on Lowland meadow (receptor of District (Low) value) would be Negligible Adverse leading to effects of Neutral or Slight significance.

10.9.234 For the species-rich grasslands (County (Medium) value) the magnitude of impacts would also be Negligible Adverse and the significance of effects would be Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.9.235 The impacts of grassland management, assuming this takes into account the objectives of the Trunk Road Estate BAP habitat action plan for Lowland meadows, particularly in managing the species-rich grasslands, would be beneficial.

10.9.236 Assuming that the SSSI Mitigation Strategy (Appendix 10.35) is implemented, then the improved management of existing grasslands, and ongoing management of grasslands established on land which is currently arable, would increase the beneficial effects of management.

10.9.237 The magnitude of impacts would then be No change and the significance of effects Neutral.

Dormouse

Assessment of Potential Effects

10.9.238 Taking into account measures included as part of the Scheme, in particular measures to limit the potential for and likely impact of light spill, and planting of woodland and scrub of potential value to dormice, if surviving displaced dormice return to the area, the likely magnitude of the impact of operation without mitigation on dormice (of County (Medium) value) is assessed as Minor Adverse. This would lead to effects of Slight significance due to the limited potential for injuries or fatalities on the road.

Assessment of Effects with Additional Mitigation

10.9.239 Taking into account additional mitigation measures, in particular the long term management and maintenance of habitats of potential value to dormice or the dormice receptor site(s); the long term monitoring of dormice populations; and maintenance of and mammal crossings, the likely magnitude of impact of

operation with mitigation on dormice is assessed as Negligible Adverse leading to effects of Neutral or Slight significance.

Badger

Assessment of Potential Effects

10.9.240 Taking into account the installation of mammal exclusion fencing around the operational boundary of the new road (as shown on the EMP at Figure 2.6), the likely magnitude of impact of operation of the new section of motorway on badgers (of District (Low) value) is assessed as Moderate Adverse. This would lead to effects of Slight significance.

Assessment of Effects with Additional Mitigation

10.9.241 Taking into account additional mitigation measures, in particular the use of fencing to help guide badgers into box culverts and dry mammal crossings, and the monitoring of replacement badger setts to ensure that they are used by badgers, the likely magnitude of impact of operation of the new section of motorway on badgers is assessed as Minor Adverse leading to effects of Neutral or Slight significance.

Hedgehog

Assessment of Potential Effects

10.9.242 Taking into account measures included as part of the Scheme, in particular measures to limit light spill and the installation of mammal exclusion fencing, the likely magnitude of impact of operation of the new section of motorway on hedgehogs (of District (Low) value) is assessed as Moderate Adverse leading to effects of Slight significance.

Assessment of Effects with Additional Mitigation

10.9.243 Taking into account additional mitigation measures, in particular the long term management of habitats of potential value to hedgehogs, the likely magnitude of impact of operation on hedgehogs is assessed as Minor Adverse leading to effects Neutral or Slight significance.

Industrial Land

10.9.244 The Industrial Land Ecological Unit includes the following VERS.

- Open mosaic habitats on previously developed land.
- Reptiles (Common lizard, slow worm).
- Terrestrial invertebrates.

10.9.245 The overall impacts of the operation of the new section of motorway on the Ecological Unit are described first with a description of the mitigation which is included in the design of the Scheme and then the additional mitigation proposed. Then the impacts on each of the relevant VERs is assessed.

Severance/Fragmentation of Habitats or Corridors

10.9.246 As explained in Section 10.4, there are areas of 'brownfield' land at Great Pencarn, south of the Solutia works, in Newport Docks, south of the Tata Steelworks at Llanwern and at Green Moor. The land at Great Pencarn is entirely to the north of the line of the new section of motorway and following completion of the Scheme there would be no severance of this site. Within Newport Docks the embankment of the new section of motorway and junction for the link to Docks Way would sever the open mosaic habitat retained to the south of the new section of motorway from the area of the reinstated construction site east of the Docks Way link to the north. The Docks Way link itself would also sever the restored construction area from the landfill site to the west. East of the River Usk the new section of motorway would be on a viaduct across the area of 'brownfield' land extending around the south of the Solutia works so there would be no significant severance of habitat in this area. Further east, the brownfield land within the Tata Steel land, including the restored construction areas would be largely to the north of the road, although, as described earlier in this section, the new section of motorway would sever this land from the Gwent Levels grazing marshes to the south.

Noise

10.9.247 The VERs associated with brownfield sites, terrestrial invertebrates and reptiles, are unlikely to be particularly sensitive to the noise arising from the operational motorway.

Wildlife Fencing

10.9.248 In order to prevent injury or fatality to mammals on the new section of motorway, wildlife exclusion fencing would be maintained alongside the restored Great Pencarn construction site and at Tata Steel. There would be no requirement for fencing through Newport Docks or south of the Solutia Works due to the nature of the motorway in these areas.

10.9.249 Mammal fencing would be installed under the supervision of an appropriately experienced person so as to ensure there were no gaps along the fence.

Wildlife Movement

10.9.250 The new section of motorway would introduce a barrier to the movement of terrestrial invertebrates (other than those species able to fly) and reptiles (common lizard and slow worm). Whilst the box culverts with adjacent 900 mm mammal tunnels, and other dry mammal crossings would provide crossing points across the new road, these are unlikely to be used by these species.

Operational Lighting

10.9.251 As described in Chapter 2: Scheme Description, lighting is proposed at the following locations.

- On the approaches to and throughout the Castleton Interchange.
- On the approaches to the Docks Way Junction and over the full extent of the River Usk Crossing.

- 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.
- On the approaches to and throughout the Magor Interchange.

10.9.252 Where present lighting would be directed towards the new section of motorway and away from adjacent habitats. However, some night-flying invertebrates would still be attracted by the lighting and their behaviour disrupted.

Long Term Management and Maintenance

10.9.253 As explained in Section 10.4, the Welsh Government's Trunk Road Estate BAP includes a Species Action Plan for Reptiles. This recognises that:

"Within the soft estate, the management of road verges may have a significant impact on reptile populations. The species most likely to be affected in Wales are slow worms, adders and common lizards. Management activities which are most likely to adversely affect reptiles are strimming and mowing. The natural succession of vegetation on a site to mature woodland naturally causes habitats to become unsuitable for reptiles over time, therefore the removal of scrub could be beneficial."

10.9.254 The objectives of the action plan include the aim of adhering to new best practice advice as it is developed (with respect to road construction and maintenance), and to identify opportunities for enhancement during road design and construction.

10.9.255 Habitats within the highway boundary, such as the south facing embankments of the new section of motorway and the water treatment areas, would be suitable habitat for reptiles, and also for terrestrial invertebrates. Following the initial period of management under the construction contract, then management would be carried out by the South Wales Trunk Road Agent, taking account of the Trunk Road Estate BAP.

Open Mosaic Habitats on Previously Developed Land

Assessment of Potential Effects

10.9.256 As explained above, the magnitude of the loss of Open mosaic habitats on previously developed land (County (Medium) value) has been assessed under the overall land take and construction of the new section of motorway in Sections 10.7 and 10.8. The magnitude of the continuing impacts as a result of severance of this habitat by the operational new section of motorway would be Minor Adverse. The significance of effects would be Slight.

Assessment of Effects with Additional Mitigation

10.9.257 The sympathetic restoration of the construction areas at Great Pencarn, Newport Docks and Tata Steel has been considered in Section 10.8. No additional mitigation for the operational effects on the Open mosaic habitats on previously developed land is proposed and the assessment of the magnitude of the operational impacts remains as Minor Adverse and the significance of effects as Slight.

Reptiles (Common Lizard, Slow worm)

Assessment of Potential Effects

10.9.258 The magnitude of the operational impacts on the populations of these species (District (Low) value), taking into account the extent of suitable habitat included in the Scheme and shown on the EMP (Figure 2.6) is assessed as Minor Adverse and the significance of effects as Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.9.259 No additional mitigation for operational effects on Common lizard and Slow worm are proposed and the assessment of the magnitude of the effects of operation of the road would remain as Minor Adverse and the significance as Neutral or Slight.

Terrestrial Invertebrates

Assessment of Potential Effects

10.9.260 The magnitude of the operational impacts of the new section of motorway on the terrestrial invertebrate assemblage (Regional (Medium) value) taking into account the extent of suitable habitat included in the Scheme is assessed as Minor Adverse and the significance of effects as Slight.

Assessment of Effects with Additional Mitigation

10.9.261 No additional mitigation for operational impacts on terrestrial invertebrates are proposed and the assessment of the magnitude of the operational impacts remains as Minor Adverse and the significance of effects as Slight.

Bats

10.9.262 A study by Berthinussen and Altringham (2012) identified low bat activity and diversity extending to up to 1.6 km on either side of a well-established major road (the M6 motorway in Cumbria) which they considered showed that roads have a long term negative impact on bat populations and that the scale of the impact was interpreted as indicating a barrier effect and that:

'….Mitigation can remove the barrier and/or remove its impact. To remove the barrier, we must make roads permeable and safe. Crossing points must connect effectively with known commuting routes to reduce the risk of abandonment and take bats safely under or over roads. Appropriate structures will be site specific and determined by local geography. Crossing structures have been installed throughout Europe in recent years, but because of inadequate and unfocused monitoring, there are no data to assess their effectiveness at either individual or population level……. We must assess the effectiveness of current structures and build only those shown to work. To reduce the effect of the barrier, we should improve foraging habitat for bats within 1 km of the road. Demographic effects will be slow to reveal themselves, and monitoring over 10 years may be necessary to provide an insight into the full effects of road developments and mitigation on bat populations'

10.9.263 Subsequent research by the same authors (Berthinussen and Altringham, 2015) found that:

"Little evidence exists for the effectiveness of currently used mitigation structures for bats on roads, such as underpasses, bridges and wire gantries. Recent reviews of case studies of bat mitigation in the UK found that most reports were qualitative and inconclusive…… and failed to make the important distinction between the use of structures by individuals and the effectiveness of structures in maintaining local population sizes. Without this information it is impossible to know whether mitigation measures are effectively protecting local bat populations from adverse effects, as required by law. Reliable methods that can be used in EIA and proven robust in identifying effective bat mitigation are needed to ensure a more efficient development process and more positive outcomes for bats."

10.9.264 The authors (Berthinussen and Altringham, 2015) set out "Best practice principles for bat mitigation along linear transport infrastructure" and suggest, based on the evidence available at present, that the best solution is a combination of underpasses and green bridges along the length of linear infrastructure to maintain bat commuting routes and increase the permeability of the infrastructure. Although the design and placement of mitigation structures will be site and species-specific, they indicate that the following general principles are likely to contribute significantly to the success of these crossing structures.

- Mitigation should be integrated into the Scheme from the earliest opportunity

  Mitigation should be considered during the planning and design stage of the infrastructure so that it can be incorporated effectively.

- Crossing structures should be placed on the exact location of existing bat commuting routes.

  Attempts should not be made to divert bats from their existing commuting routes.

- Crossing structures should not require bats to alter flight height or direction

  This will depend on the topography of the site. If the road is to be elevated above ground an underpass may be used to preserve the commuting route below it, or if the road is in a cutting a green bridge may be used to carry the commuting route over the road.

- Crossing structures should maintain connectivity with existing bat commuting routes.

  Connectivity must be maintained with undisturbed bat flight paths (e.g. treelines, hedgerows, woodland rides and streams), and bat habitat (e.g. Woodland) within the surrounding landscape. Crossing structures should not be exposed or sited within open ground.

- Over-the-road structures such as green bridges should be planted with vegetation.

  Vegetation should be continuous and connected (see above) and sufficiently mature before road construction (e.g.by planting relatively mature trees or fast growing tree species in advance of construction commencing).

- Underpasses should be of sufficient height

  Underpasses should be as spacious as possible with height being the critical factor. The minimum requirements for underpass height will be species-specific. Required heights will generally be lower for woodland-adapted

species (~3 m) compared to generalist edge-adapted species (~6 m), but larger underpasses will accommodate more species.

- Green bridges should be of sufficient width.

  In addition to being vegetated, green bridges should be as wide as possible to provide a large area for bats to commute across. Further research is needed to determine exact dimensions. We found a 30 m wide green bridge to be effective in this study.

- Crossing structure should be unlit.

  The effects of light on bats are species-specific and lighting should be avoided.

- Access and connectivity must be maintained

  It is important that access to crossing structures is maintained (e.g. grilles should not be installed on underpasses and that connecting vegetation is maintained indefinitely or for as long as the mitigation structure is required.

- Disturbance should be minimised during installation of mitigation structures.

  For example, by limiting noise and light pollution along the flight path, minimising vegetation clearance, installing suitable temporary crossing structures (which should also be subject to monitoring and evaluation."

10.9.265 The measures proposed to ensure that bats are able to cross the new section of motorway have been described in Section 10.5. The areas of planting and species-rich grassland, together with the water treatment areas associated with the Scheme would provide improved foraging habitat.

10.9.266 As explained above, operational lighting would be restricted to the following locations.

- On the approaches to and throughout the Castleton Interchange.
- On the approaches to the Docks Way Junction and over the full extent of the River Usk Crossing.
- 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.
- On the approaches to and throughout the Magor Interchange.

10.9.267 Where present operational lighting would be directed towards the new road and away from adjacent habitats.

Bat Roosts

10.9.268 All replacement and new bat roosts required under the bat licence would be monitored by appropriately experienced ecologists during the construction period and for a an additional period after completion of the new motorway which would be defined in the European Protected Species licence. Monitoring of roosts would aim to determine use by bats and, where present, species and number of roosting bats present. Reporting of monitoring surveys is likely to be at least on an annual basis or as otherwise requested by NRW.

10.9.269 Results would inform the need for any further mitigation measures, such as a relocation of bat roost boxes in order to increase use or provision of additional roost boxes.

Risk of Injuries and Fatalities – Foraging and/or Commuting Bats

10.9.270 Roads present a risk of injury and fatality to bats as a result of collision with vehicles. There is no evidence to show that bats will time their flights in order to avoid vehicles, and in particular young dispersing bats or low-flying, gleaning species (such as Bechstein's and Daubenton's bats) are more at risk of collision than higher-flying species (such as noctules and barbastelles, that could travel above vehicle height). Due to this risk, the proximity of a road to a maternity roost can be of considerable concern with regard to the impact on females and young in a population (Highways Agency, 2011).

10.9.271 The retention of severed sections of habitat corridors (such as hedgerows), which are used by bats as commuting routes, too close to a new road may increase the risk of collision as bats may try to continue to use these commuting routes to cross the road (Highways Agency, 2011).

10.9.272 In accordance with Highways Agency recommendations (Highways Agency, 2011), 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. The presence of hard shoulders would also assist in this. In addition, planting would be designed so as to help guide bats towards alternative safe crossing points constructed along the route, i.e. box culverts and adjacent 900 mm mammal tunnels, other dry mammal crossings, underpasses and overbridges.

10.9.273 Mammal exclusion fencing would be installed along the operational boundaries of the new section of motorway, and would also be aligned so as to help direct low flying bats towards the alternative crossing points (i.e. box culverts, dry mammal crossings, underpasses and overbridges).

Disruption of Bat Movement

10.9.274 As described in Sections 10.7 and 10.8, the route of the new section of motorway would result in the severance of a number of bat commuting routes (Appendices 10.7 and 10.23). Therefore, box culverts, mammal crossings, underpasses and overbridges (shown on the EMP - Figure 2.6 and described in Chapter 2: Scheme Description would be constructed along the new section of motorway as alternative crossing points in order to minimise the potential impact of the severance of commuting routes.

10.9.275 In addition to the mitigation measures described under *Risk of injuries and fatalities – foraging and/or commuting bats* above, which would be designed to guide bats towards these alternative crossing points, temporary artificial bat corridors would be installed at or close to sites where high and very high bat activity has been recorded (Appendices 10.7 and 10.23 and Figure 10.8). These would be located so as to direct bats towards alternative crossing points until new planting has developed sufficiently to provide a long term dense and continuous habitat corridor for bats to follow.

Operational Lighting

10.9.276 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 (Stone *et al*. 2009; Wray *et al*. 2005), lighting can act as a deterrent affecting commuting, dispersal and population interactions.

10.9.277 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 (Stone, 2013). 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.

Long Term Maintenance and Management

10.9.278 Replacement and additional planting, and habitat creation of potential value to bats (including woodland and scrub planting, water treatment areas, watercourses and rough grassland creation) would be monitored during a five year maintenance period under the contract so as to assess the success of establishment and inform on-going management requirements.

10.9.279 Following the establishment period, the South Wales Trunk Road Agent would be responsible for ensuring the long term maintenance and management of new and replacement habitats provided as part of the Scheme.

10.9.280 The South Wales Trunk Roads Agent would also be responsible for ensuring the long term management of the SSSI Mitigation Areas in accordance with principles set out in the SSSI Mitigation Strategy (Appendix 10.35). This would include details relating to responsibilities, financing, monitoring and reporting. Areas of species rich grassland and vegetated reens would support invertebrate populations of value to foraging bats.

10.9.281 SWTRA would be responsible for ensuring the long term monitoring and maintenance of features within the operational boundaries of the new road, including the mammal exclusion fencing, bat corridors, box culverts, underpasses and overbridges, and the bat house.

Operational Monitoring

10.9.282 Although measures described above are recommended by the Highways Agency (2011) on the basis of research findings to date, there is limited firm evidence to confirm the effectiveness of such measures. Therefore, monitoring would form an important part of the bat mitigation strategy for the Scheme. Monitoring requirements would be agreed with NRW and specified in the European Protected Species Licence for bats and would be likely to include the following.

- Annual monitoring of bat activity along existing commuting routes and new crossing points (including associated landscape planting, mammal exclusion

fencing and artificial bat corridors), during construction and for a subsequent period during operation.

- Annual monitoring of bat roosts during construction and for a subsequent period during operation .

10.9.283 Results of bat surveys undertaken in order to inform this ES (Appendices 10.7 and 10.23) illustrate that bat activity varies throughout the year. Therefore, monitoring surveys would be undertaken throughout the bat activity season in order to develop a better understanding of the impacts of the new section of motorway on bats. Monitoring surveys would be completed with regard to survey guidelines published by the Bat Conservation Trust (Collins, 2015) and as required by the European Protected Species Licence.

10.9.284 Results of the monitoring surveys would be analysed quantitatively rather than subjectively and in accordance with NRW requirements.

10.9.285 Results of surveys would be provided to NRW on at least an annual basis or as otherwise requested by NRW, and would be used to inform the need for any amendments to mitigation and ongoing habitat management in order to ensure effectiveness and inform the need for amendments to the mitigation, such as additional bat boxes or planting, or alterations to lighting. Such additional bat boxes could be located in the SSSI mitigation areas or new woodland planting which is included in the Scheme.

Assessment of Potential Effects

10.9.286 Taking into account the methodology for assessing the value of a site for bats developed by Wray et al. (2010) the value of the corridor for the new section of motorway for some bat species, for example pipistrelle, brown long-eared and lesser horseshoe bats, is of District (Low) value. However, considering all species recorded on site, including the rarer species such as lesser and greater horseshoe bats and barbastelle bats, the local bat population as a whole is of Regional (Medium) value. Taking into account the potential risk of vehicle collision for some species which may cross the new road, and the long term disruption to the movement of all bat species but in particular those species unlikely to cross the new road, and accepting that the exact level significance of impact is not possible to estimate as vehicle collision risk cannot be predicted, the magnitude of the potential impact of operation without mitigation is assessed as Moderate Adverse and the significance of effects as Moderate.

Assessment of Effects with Additional Mitigation

10.9.287 Taking into account additional mitigation measures, 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, the potential impact of operation of the new section of motorway on the local bat population could be reduced to Minor Adverse and the significance of effects to Slight.

10.9.288 However, as above, the exact significance of impact is not possible to estimate as evidence relating to the effectiveness of mitigation described above is limited, and the probability that bats would use the culverts and/or mammal crossings or will cross the new section of motorway without injury is not possible to predict

exactly. Therefore, on a precautionary basis the magnitude of impact is assessed as Moderate Adverse and the significance of effects as Moderate. Monitoring of the effectiveness of mitigation would form an important part of the post-construction monitoring for the new section of motorway.

Breeding Birds

10.9.289 The main impact of the operation of the new section of motorway on breeding birds would be disturbance and displacement. These effects arise from both visual and noise disturbance, and would extend beyond the development boundary on habitat which may have otherwise been suitable for breeding birds, including reen habitat proposed to be created during mitigation. Given the nature of the breeding birds identified during the 2014 and 2015 studies, the possibility of any barrier effects as a result of construction is considered to be low.

10.9.290 Figure 3.3 shows that current background noise levels in the vicinity of the new section of motorway, including where the bulk of Cetti's warbler records were located is currently approximately 45-50 dB(A)$_{L10(18h)}$. The noise levels expected during operation are likely to be in the region of 60-70 dB(A)$_{L10(18h)}$ (see Figure 13.6).

10.9.291 Barn owl is known to be susceptible to collision with moving vehicles due to its horizontal hunting techniques. Barn Owls are known to interact with roads by crossing the road in direct flight, or flying along the road verge, or hunting from roadside posts or bushes for small mammals.

10.9.292 Research indicates (Shawyer and Dixon, 1999) that it would be neither effective nor practical to recommend the elimination of continuous stretches of rough grassland from the verges of trunk roads and motorways by frequent mowing or the saturation planting of bushes and trees. To have any effect in discouraging barn owls these measures would need to be implemented over long stretches of road and are likely to act in a negative way on other animal and plant communities which depend on these semi-natural grasslands. Because barn owls remain relatively safe when confining their activities to road verges themselves it is recommended that these linear stretches of rough grassland should be continuous and not interrupted by the planting of long impenetrable blocks of dense trees or shrubs which extend the full width of the verge. On verges where shrubs or trees are to be planted or where they already exist, a swathe of grassland two or more metres wide should be left or cut through the centre of these 'barriers' to maintain continuous flightpaths of open grassland in order to discourage barn owls from diverting into the road itself.

10.9.293 The landscape provisions on the EMP (Figure 2.6) provide linear grassland habitat along the proposed motorway verges through the Gwent Levels. The vegetated verges on a motorway are separated from the carriageways by the hard shoulder which provides a buffer between the potential barn owl feeding habitat and the traffic on the road. There would also be an area of marshy grassland south of the road at chainage 17900 to chainage 19100 in the vicinity of the existing potential barn owl nest and nest boxes which would be provided during the construction phase (as described in Section 10.7), and which would be an attractive hunting area for barn owl.

Assessment of Potential Effects

10.9.294 Although herring gull and lesser-black backed gull were reported in the study area, no named breeding species of the Severn Estuary SPA or Ramsar sites were recorded exhibiting breeding behaviour within and in the immediate vicinity of the new section of motorway. Any disturbance or displacement that occurs as a result of operation would not result in disturbance to these named breeding species. The predicted magnitude of impact is thus No change. Therefore, in terms of the operational phase, the significance of effects on qualifying breeding species of European designated sites would be Neutral.

10.9.295 The potential for operational disturbance extends beyond the footprint of the new section of motorway. Of the 44 species recorded breeding over 2014 and 2015, Cetti's warbler is the highest value single breeding bird species (National (High) value). Cetti's warbler is a songbird, so is likely to be the subject of masking impacts through noise as well as other noise-related effects and visual disturbance. The impact of noise disturbance of varying levels at different distances from birds is not well understood in this species.

10.9.296 The likely interaction of barn owls (County (Medium) value) with the road are described above. Populations of all other breeding birds using the study area have been classified as being of District (Low) value. These species would be more likely to be affected by visual disturbance, though effects through noise disturbance cannot be ruled out.

10.9.297 Due to the spatial and temporal scale of operational impacts, the predicted magnitude of impact for breeding birds is Moderate Adverse. The significance of effects on Cetti's warbler would be Moderate or Large. For barn owl the significance of effects would be Moderate. For all other species that use the study area during the breeding season, the significance of effects would be Slight.

Assessment of Effects with Additional Mitigation

10.9.298 The additional mitigation that has been taken into account in this section is the ongoing management of the new reens and water treatment areas, which would develop as suitable habitat for Cetti's warbler and other wetland breeding birds. The management of the extensive woodland and other planting included in the Scheme as shown on the EMP (Figure 2.6) would also provide extensive habitat for woodland birds. The SSSI Mitigation Areas (Appendix 10.35) would provide extensive hunting areas for barn owl away from the road.

10.9.299 With additional mitigation taken into account there is no change in the assessment of the magnitude of impact with respect to the breeding bird components of the Severn Estuary SPA or Ramsar site. This remains as No change and the significance of effects as Neutral.

10.9.300 Although there would be provision of alternative habitat for Cetti's warbler, the location of the new reens and ditches close to the road may limit their value as breeding habitat. Therefore for the purposes of this assessment it is assumed that the magnitude of impact on this population resulting from operation of the road would remain as Moderate Adverse and the significance of effects would remain as Moderate or Large.

10.9.301 For barn owl the magnitude of impact would be reduced to Minor Adverse and the significance of effects to Slight. For other breeding bird species identified in the study area, there would be no change in the magnitude of impacts which would remain as Moderate Adverse and the significance of effects as Slight.

Wintering Birds

10.9.302 The main impact of the operation of the new section of motorway on wintering birds would be disturbance and displacement. In addition, there is the possibility of habitat fragmentation where birds are using areas of the Rivers Ebbw and Usk upstream and downstream of the proposed crossing locations. Displacement and disturbance effects would exert influence beyond the boundary of the new section of motorway into habitat which may have otherwise been suitable for wintering birds. Due to the nature of the development these impacts should be viewed as being permanent.

10.9.303 Named wintering components of the Severn Estuary SPA/Ramsar site utilise areas of suitable habitat outside the site boundary. The most important areas within the study area for wintering birds associated with the Severn Estuary SPA/Ramsar site are the River Ebbw and River Usk, of which the latter is designated as an SSSI and SAC. The assessment focuses on these areas.

10.9.304 During the wintering bird surveys, it was determined that for three named species the study area population is of National (High) value (redshank, gadwall and pintail), for three named species the study area population is of County (Medium) value (teal, pochard and shoveler), and for six named species the study area population is of District (Low) value (shelduck, wigeon, tufted duck, curlew, lapwing and mallard). In addition, an array of species that are considered to represent part of the Severn Estuary SPA/Ramsar assemblage was recorded within the study area. This assemblage within the study area is also of District (Low) value.

10.9.305 Other wintering species recorded in the study area are considered to be relatively flexible in the selection of winter habitats.

10.9.306 The locations of the river crossings are in areas that are already subject to relatively high degrees of anthropogenic activity and disturbance. Background noise in the vicinity of the proposed river crossing at the River Usk (see Figure 13.3) is currently 45-50 $dB(A)_{L10(18h)}$ in, rising to 50-55 $dB(A)_{L10(18h)}$ within 300 m upstream, and falling to 40-45 $dB(A)_{L10(18h)}$ within 500-700 m downstream. On the River Ebbw, the current background noise level at the site of the proposed crossing is 45-50 $dB(A)_{L10(18h)}$. Upstream the background noise level is the same. It falls to 45-50 $dB(A)_{L10(18h)}$ directly downstream of the proposed crossing.

10.9.307 The response of some of the species known to be present at the proposed crossings to visual and noise disturbance has been characterised by the Waterbird Disturbance Mitigation Toolkit (TIDE, 2013), from where the following information has been extracted.

10.9.308 Redshanks are relatively tolerant of visual disturbance, and habituate rapidly. They are highly sensitive to noise disturbance. It is likely that visual disturbance would occur at distances within 100 m to works. A noise level of up to 70 db may be acceptable at the bird (100-105 db at source assuming birds are 100 m away), but with caution recommended above 60 db at the bird (92 db at source when birds are 100 m away) in disturbed areas.

10.9.309 Shelducks are sensitive to disturbance, but it should be noted that the species is generally subject to a high degree of habituation. Shelducks can be affected by visual disturbance up to 500 m from source, with a minimum approach distance of 150 m. For noise disturbance, noise levels of 115-120 db at source would create a high level of disturbance (assuming birds are 150 m away). This increases to 125-130 db at 500 m.

10.9.310 Curlews are of moderate disturbance sensitivity, with an approach distance of 120-550 m before flushing. At a bird distance of 100 m, a noise to produce a high disturbance response would need to be in the region of 107-112 db, increasing to 117-122 db at 300 m bird distance.

10.9.311 Mallards are relatively tolerant to disturbance, and habituate rapidly to activity. In disturbed areas such as the study area, mallard visual disturbance ranges between 25-300 m. A noise of up to 72 db at the bird (105-110 db at source if the bird is 50 m away) is acceptable, with caution recommended at 60 db (87-92 db at source if the bird is 50 m away).

Assessment of Potential Effects

10.9.312 As explained in Section 10.8, construction of the new section of motorway at the river crossings would result in a localised (judged to be approximately 300 m up and downstream based on the species present) visual displacement/disturbance effect, which would have the greatest influence on those birds that regularly use the habitat directly in and adjacent to the proposed crossing footprints. For operation, this distance would be expected to reduce due to habituation. Further away from the new section of motorway disturbance/displacement effects would reduce. Based on the results of the wintering bird surveys, the named component of the Severn Estuary SPA/Ramsar site that would be most abundant, and therefore most exposed to this effect, is redshank. For this reason, the assessment is based on the parameters for this species described above in terms of disturbance.

10.9.313 Figure 13.6 shows that, with committed mitigation, noise levels at ground level during operation are likely to be between 50 and 60 dB(A) $_{L10(18h)}$ around the River Usk crossing and 60 to 65 dB(A)$_{L10(18h)}$ around the River Ebbw crossing. Noise levels along the new section of motorway either side of the crossings indicate that at road height, levels of 65-75 dB(A)$_{L10(18h)}$ are likely in the immediate vicinity of the crossings. Based on the information from the Waterbird Disturbance Mitigation Toolkit (TIDE, 2013), and the fact that these areas are already subject to relatively high levels of background noise, this may not result in a discernible effect. The presence of a water crossing may cause sufficient traffic and associated disturbance to discourage birds from roosting and feeding nearby. These effects are discussed in Avian Ecology Unit (1994) in relation to new bridge construction in Scotland on the Firth of Forth (now designated as an SPA) where no evidence was found to show that mudflat characteristics beneath bridges differed significantly from those elsewhere. In a composite site analysis across a series of locations, redshank were found to be more common adjacent to bridges than elsewhere. This was hypothesised to be the result of the bridge supports on water movements with consequential upturn in sediment deposits and the newly created availability of roost sites that provided shelter from the elements, which in turn may make prey easier to detect. Bridges also provide an element of shelter from winds, helping to reduce windchill on roosting birds which is likely to prove attractive. Whilst in the case of the River Usk and River Ebbw

crossings there would be no new structures in the river, it is evident that the presence of the bridge itself in this case did not have a deterrent effects on the birds.

10.9.314 When assessing the potential impact of operation, the availability of alternative habitat for any birds that are disturbed and/or displaced on a longer term basis should also be considered. It has been reported that in recent years, the Severn Estuary SPA wader population has generally declined (Burton *et al*. 2010). A search of the literature found no reporting of habitat loss for wading birds, and nothing to suggest that three of the five conservation objectives underpinning the SPA relating to habitat (the extent and distribution of the habitats of the qualifying features, the structure and function of the habitats of the qualifying features and the supporting processes on which the habitats of the qualifying features rely) are not being met. It is therefore reasonable to assume that ample habitat to support the waders recorded in the study area exists within the SPA boundary, so alternative habitat for these birds is available beyond the area over which impacts of the new section of motorway are expected to have an influence.

10.9.315 Based on this information the magnitude of impact is judged to be Negligible Adverse . Therefore, with respect to operation, the significance of effect for the wintering birds that are part of the Severn Estuary SPA/Ramsar site would be Slight for species of National (High) value (redshank, gadwall and pintail), and Neutral or Slight for species of County (Medium) value (teal, pochard and shoveler), for those of District (Low) value (shelduck, wigeon, tufted duck, curlew, lapwing and mallard), and for the other species that make up part of the Severn Estuary SPA/Ramsar assemblage.

10.9.316 For other species recorded within the study area, the magnitude of impact during operation is judged to be Minor Adverse. The significance of effect would therefore be Neutral or Slight.

Assessment of Effects with Additional Mitigation

10.9.317 No mitigation for noise effects on wildlife is proposed with respect to the operation of the Scheme.

10.9.318 The magnitude of impact is judged to be Negligible Adverse . Therefore, with respect to operation, the significance of effect for the wintering birds that are part of the Severn Estuary SPA/Ramsar site would remain as Slight for species of High value (redshank, gadwall and pintail), and Neutral or Slight for species of Medium value (teal, pochard and shoveler), for those of Low value (shelduck, wigeon, tufted duck, curlew, lapwing and mallard), and for the other species that make up part of the Severn Estuary SPA/Ramsar assemblage.

10.9.319 For other species recorded within the study area, the magnitude of impact during operation is judged to be Minor Adverse. The significance of effect would remain as Neutral or Slight.

Complementary Measures

10.9.320 As referred to in Section 10.3, the Complementary Measures which are proposed are described in Chapter 2: Scheme Description. The limited nature of the works proposed, which are entirely within the existing highway land, means that no significant ecological effects of operation of the re-classified existing M4 are likely over and above the existing baseline.

10.10 Assessment of Cumulative Effects

10.10.1 The cumulative effects of the Scheme with other projects in the vicinity are addressed in Chapter 17: Assessment of Cumulative Effects.

10.11 Inter-relationships

10.11.1 In identifying and assessing the impacts of the new section of motorway on ecology and nature conservation, it has been essential to consider the inter-relationships with the environmental impacts identified in other ES chapters and this has involved discussions with the other topic authors.

10.11.2 The information set out in Chapter 2: Scheme Description and Chapter 3: Scheme Construction (including the environmental protection measures to be included in the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2), and the Buildability report at Appendix 3.1) has provided the basic information upon which to base the assessment of the effects of the Scheme as a result of land take, operation and construction.

10.11.3 The modelling of changes in air quality set out in Chapter 7: Air Quality has informed the assessment of the ecological effects on sensitive ecological sites and habitats. Similarly Chapter 13: Noise and Vibration has provided the modelling of changes in noise which has informed the assessment of disturbance of sensitive species.

10.11.4 Chapter 9: Landscape and Visual Effects, and the Environmental Masterplan (EMP) in Figure 2.6, provide the information on the landscape provision included as part of the Scheme, including the ecology mitigation planting and other habitat provision, and has been used to measure the areas of such planting.

10.11.5 Chapter 15: Community and Private Assets has informed consideration of land ownership and current land management, which has been important in identification of areas for mitigation planting and SSSI mitigation.

10.11.6 Chapter 16: Drainage and the Water Environment has informed the measurement of losses and replacement of reens and ditches, and been important as the source of information on management and treatment of runoff from the construction site and the completed Scheme.

10.11.7 Chapter 17: Assessment of Cumulative Effects provides information on the nature and location of other local plan allocations, planning applications and other proposed developments which have been considered, and provides the assessment of the potential cumulative effects with such plans and projects for ecology and nature conservation.

10.11.8 An Assessment of Implications (of highways and/or roads projects) on European Sites (AIES) has been carried out in accordance with Design Manual for Roads and Bridges (DMRB) Volume 11, Section 4, Part 1 (HD44/09) (Highways Agency, 2009) and is reported separately. In so far as habitats and species considered in this chapter are qualifying features of the European designated sites assessed in the AIES, the AIES has drawn on the assessments set out in this chapter.

10.12 Summary of Residual Effects

10.12.1 The proposed new section of motorway would pass through European, nationally and locally designated sites, and would affect habitats that support protected and notable species, such as bats, otter, dormouse, water vole, badger, hedgehog, reptiles, great crested newts and other amphibians, birds, fish, invertebrates and plant species.

10.12.2 Effects on the European Sites have been assessed separately in a process known as Assessment of Implications (of highways and/or road projects) on European Sites, and the results of the assessment have been provided in the form of a Statement to Inform an Appropriate Assessment (Welsh Government, 2016a).

10.12.3 As explained in Section 10.5, this chapter has assessed the impacts of the Scheme, firstly the potential effects with the mitigation which is an integral part of the Scheme, and then taking into account proposed additional mitigation. The results of the assessment are summarised in Table 10.19.

10.12.4 The mitigation which is considered to be integral to the Scheme in the initial assessment of potential effects includes standard measures to control pollution during construction to be implemented through a Construction Environmental Management Plan (CEMP) following the principles set out in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), and the Outline Ground and Surface Water and Groundwater Management Plan (Annex G to Appendix 3.2).

10.12.5 As explained in the Pre-CEMP (Appendix 3.2), an Environmental Co-ordinator (ECO) would be responsible for the interface between the environmental specialists and engineers. The ECO would have primary responsibility for managing environmental issues through the construction and post-construction monitoring phases and for obtaining relevant licences and consents.

10.12.6 The Environmental Clerk of Works (ECOW) would support the ECO during construction and aftercare. The ECOW would be the site representative for the ECO and would be responsible for overseeing construction activities to ensure all environmental commitments are met and compliance with the conditions of all licences and permits. The ECOW would be based on site full time and would have the authority to direct members of the contractor's site staff on environmental issues.

10.12.7 Mitigation measures which are integral to the Scheme Design comprise the following.

- No construction in the wetted channels of the Rivers Usk and Ebbw (defined as the channel below Mean High Water as explained in Chapter 2: Scheme Description).
- Minimise land take within the Gwent Levels SSSIs and where practical avoiding land take to the south of the line of the new section of motorway.
- Provision of water treatment areas to control the volume and quality of water discharged to the reen system.
- Maintaining all existing reen connections across the line of the new section of motorway.

- Provision of permanent mammal fencing along the new section of motorway.
- Avoidance of lighting other than at junctions and the river crossings.
- Replacement of reens at a ratio of greater than 1:1.
- Replacement of field ditches at a ratio of greater than 1:1
- Landscape/habitat provision shown on the Environmental Masterplan (EMP) (Figure 2.6).
- Replacement of saltmarsh.

10.12.8 After assessing the impacts of the Scheme taking account only of the above integral mitigation, the effects have been assessed with the additional proposed mitigation in place and this comprises the following.

- Design of lighting of the River Usk and River Ebbw crossings to avoid lighting of the river channels and banks.
- Minimise light spill through lighting design.
- Provision of mammal crossings at suitable locations across the line of the road.
- Provision of mammal tunnels adjacent to all reen culverts.
- Design of planting to guide bats to culverts.
- Provision of eel passes on all new sluices.
- Use of plant material from existing reens and ditches to encourage colonisation of new reens and ditches by aquatic macrophytes.
- Ecological enhancement of land (e.g. recutting of former ditches, removal of hedgerows, reseeding grassland) at Maerdy Farm, Tatton Farm and Caldicot Moor.
- Provision of three replacement badger setts.
- Provision of bat barn north of Magor.
- Use of woodland soils and rootstocks in new planting areas.
- Provision of bat boxes.
- Investigate the potential for translocation of waxcap turf.

10.12.9 Additional mitigation measures which would be implemented during construction, over and above standard measures to control pollution would include the following.

- Biosecurity method statement for site works, including ecology surveys.
- Capture and translocation of dormouse.
- Capture and translocation of reptiles.
- Capture and translocation of water vole.
- Capture and translocation of great crested newt.
- Removal of bat roosts at the appropriate season.
- Closure of badger setts at the appropriate season.

- Pre-construction surveys for bats, badger, water vole, otter, great crested newt and features of importance to grass snake to confirm measures required during construction.
- Clearance of vegetation suitable for nesting birds outside the bird breeding season.
- Management of surface water and groundwater during construction including maintenance of water levels in reens and field ditches, de-watering of borrow bits and provision of temporary water treatment areas.
- Construction lighting would be designed and managed to minimise light spill outside the working area.
- Installation of piles for the East Pier of the River Usk crossing outside the main fish migration period.
- Provision of mammal fencing during construction if and where required.
- Provision of means of escape from excavations.
- Provision of barn owl nest boxes.
- Construction sites at Great Pencarn, Newport Docks and Tata Steel would be restored on completion of construction.

10.12.10 Protected species licenses would be required for works affecting badgers, dormice, bats and great crested newts and these licences would be obtained from NRW prior to the commencement of works.

Table 10.19: Summary of Likely Environmental Effects on Ecology and Nature Conservation

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Land take								
European Statutory Designated Sites	Very High	Habitat loss	Long term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant
National Statutory Designated Sites	High	Habitat loss including grazing marsh	Short term	Moderate Adverse	Moderate/ Large	Moderate Adverse	Moderate/ Large	Significant
			Medium/ Long term	Moderate Adverse	Moderate/ Large	Minor Adverse	Slight/ Moderate	Significant
Non-statutory Designated Sites	Medium	Habitat loss including grassland, ancient woodland	Short term	Major Adverse	Moderate/ Large	Major Adverse	Moderate/ Large	Significant
			Medium/ Long term	Major Adverse	Moderate/ Large	Moderate Adverse	Moderate	Significant
Nature Reserves (Newport Wetlands, Magor Marsh)	High	None	Long term	No change	Neutral	No change	Neutral	Not significant
Nature Reserves (Great Traston Meadows)	Medium	None	Long term	No change	Neutral	No change	Neutral	Not significant
Rivers (Usk and Ebbw)								
Rivers	Medium (Ebbw)/ High (Usk)		Long term	No change	Neutral	No change	Neutral	Not significant
Sub-tidal benthic habitat	Medium (Ebbw)/ High (Usk)		Long term	No change	Neutral	No change	Neutral	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Intertidal mudflats	Medium (Ebbw)/ High (Usk)		Long term	No change	Neutral	No change	Neutral	Not significant
Coastal saltmarsh	Medium/ High	Loss of saltmarsh	Medium term	Minor Adverse	Slight/ Moderate (River Usk) Slight (river Ebbw)	Minor Adverse	Slight/ Moderate (River Usk) Slight (River Ebbw)	Significant
			Long term	Negligible Adverse	Slight (River Usk) Neutral/Slight (River Ebbw)	Negligible Adverse	Slight (River Usk) Neutral/Slight (river Ebbw)	Not significant
Migratory fish	Very High		Long term	No change	Neutral	No change	Neutral	Not significant
Estuarine migratory fish assemblage	High		Long term	No change	Neutral	No change	Neutral	Not significant
Reens, ditches, reedbeds and ponds								
Eutrophic standing waters	High	Habitat loss	Short term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant
Ponds	Medium	Habitat loss	Short term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
			Medium term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
			Long term	Minor Beneficial	Slight	Minor Beneficial	Slight	Not significant
Reedbeds	Medium	Habitat loss	Short term	Moderate Adverse	Moderate	Moderate Adverse	Moderate	Significant
			Medium/long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Aquatic macrophytes	High	Loss of species diversity	Short term	Minor Adverse	Slight/ Moderate	Negligible Adverse	Slight	Not significant
			Medium term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Otter	High	Habitat loss	Short/ Medium/ Long term	Minor Adverse	Slight/ Moderate	Negligible Adverse	Slight	Not significant
Water vole	Medium	Habitat loss	Short term	Moderate Adverse	Moderate	Minor Adverse	Slight	Not significant
			Medium / long term	Minor Adverse	Slight	Negligible Adverse	Neutral/Slight	Not significant
Grass snake	Medium	Habitat loss	Short term	Moderate Adverse	Moderate	Minor Adverse	Slight	Not significant
			Medium/long term	Minor Adverse	Slight	Negligible Adverse	Neutral/Slight	Not significant
Great crested newt	Medium	Habitat loss	Short term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
			Medium/long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Other amphibians	Low	Habitat loss	Short term	Minor Adverse	Neutral/Slight	Minor Adverse	Neutral/Slight	Not significant
			Medium/long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Freshwater fish assemblage	Medium/	Habitat loss	Short/ Medium/ Long term		Slight	Minor Adverse	Slight	Not significant
European eel	Very High	Habitat loss	Short/ Medium/ Long term	Minor Adverse	Slight/ Moderate	Negligible Adverse	Slight	Not significant
Freshwater invertebrates	High	Habitat loss	Short term	Minor Adverse	Slight/ Moderate	Minor Adverse	Slight/ Moderate	Significant
			Medium/long term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant
Grazing Marsh								
Coastal and floodplain grazing marsh	High	Habitat loss	Short term	Moderate Adverse	Moderate/ Large	Moderate Adverse	Moderate/ Large	Significant
			Medium/long term	Moderate Adverse	Moderate/ arge	Minor Adverse	Slight/ Moderate	Significant
Shrill carder bee	High	Habitat loss	Medium term	Moderate Adverse	Moderate/ Large	Moderate Adverse	Moderate/ Large	Significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
			Long term	Moderate Adverse	Moderate/ Large	Minor Adverse	Slight/ Moderate	Significant
Wet grassland plants	Medium	Habitat loss	Short term	Moderate Adverse	Moderate	Moderate Adverse	Moderate	Significant
			Medium/long term	Moderate Adverse	Moderate	Minor Adverse	Slight	Not significant
Farmland								
Lowland mixed deciduous woodland (Semi-natural)	Medium	Habitat loss	Short/ Medium term	Major Adverse (	Moderate/ Large	Major Adverse (	Moderate/ Large	Significant
			Long term	Major Adverse	Moderate/ Large	Moderate Adverse	Moderate (	Significant
Lowland mixed deciduous woodland (Plantation)	Low	Habitat loss	Short/ Medium term	Moderate Adverse	Slight	Moderate Adverse	Slight	Not significant
			Long term	Negligible Adverse (potentially Moderate Beneficial)	Neutral/Slight	Negligible Adverse (potentially Moderate Beneficial)	Neutral/Slight	Not significant
Hedgerows	Medium	Habitat loss	Short/ Medium/ Long term	Moderate	Moderate	Moderate Adverse	Moderate	Significant
Lowland meadow (Species-rich)	Medium	Habitat loss	Short term	Moderate Adverse	Moderate	Moderate Adverse (	Moderate	Significant
			Medium/long term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Lowland meadow (other non-SSSI)	Low	Habitat loss	Short term	Moderate Adverse	Slight	Moderate Adverse	Slight	Significant
			Medium/long term	Minor	Neutral/Slight	Minor Adverse	Neutral/Slight	Not significant
Dormouse	Medium	Habitat loss	Short/ Medium term	Major Adverse	Moderate/ Large	Minor Adverse	Slight	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
			Long term	Moderate Adverse	Moderate	Minor Adverse	Slight	Not significant
Badger	Low	Habitat loss	Short/ Medium term	Major Adverse	Slight/ Moderate	Minor Adverse	Neutral/Slight	Not significant
			Long term	Moderate Adverse	Slight	Negligible Adverse	Neutral/Slight	Not significant
Hedgehog	Low	Habitat loss	Short/ Medium term	Moderate Adverse	Slight	Minor Adverse	Neutral/Slight	Not significant
			Long term	Minor Adverse	Neutral/Slight	Minor Adverse	Beneficial	Not significant
Industrial land								
Open mosaic habitats on previously developed land	Medium	Habitat loss	Medium term	Major Adverse	Moderate/ Large	Major Adverse	Moderate/ Large	Significant
			Long term	Major Adverse	Moderate/ Large	Moderate Adverse	Moderate	Significant
Reptiles (Common lizard, slow worm)	Low	Habitat loss	Medium term	Major Adverse	Slight/ Moderate	Moderate Adverse	Slight	Not significant
			Long term	Major Adverse	Slight/ Moderate	Minor Adverse	Neutral/Slight	Not significant
Terrestrial invertebrates	Medium	Habitat loss	Medium term	Major Adverse	Moderate/ Large	Major Adverse	Moderate/ Large	Significant
			Long term	Major Adverse	Moderate/ Large	Moderate Adverse	Moderate	Significant
Bats	Medium	Habitat loss	Short/ Medium term	Major Adverse	Moderate/ Large	Moderate Adverse	Moderate	Significant
			Long term	Moderate Adverse	Moderate	Minor Adverse	Slight	Not significant
Breeding Birds								
Ramsar site named species (Lesser black-backed gull,	High	None	Short/ medium/ long term	No change	Neutral	No change	Neutral	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Herring gull)								
Cetti's warbler	High	Habitat loss	Short term	Moderate Adverse	Moderate/ Large	Moderate Adverse	Moderate/ Large	Significant
			Medium term	Moderate Adverse	Moderate /Large	Minor Adverse	Slight/ Moderate	Significant
			Long term	Minor Adverse	Slight/ Moderate	Minor Adverse	Slight/ Moderate	Significant
Barn owl	Medium	Habitat loss	Short term	Moderate Adverse	Moderate	Moderate Adverse	Moderate	Significant
			Medium term	Moderate Adverse	Moderate	Negligible Adverse	Neutral/Slight	Not significant
			Long term	Minor Adverse	Slight	Negligible Adverse	Neutral/Slight	Not significant
Other species	Low	Habitat loss	Short term	Moderate Adverse	Slight	Moderate Adverse	Slight	Not significant
			Medium term	Moderate Adverse	Slight	Minor Adverse	Neutral/Slight	Not significant
			Long term	Minor Adverse	Neutral/Slight	Minor Adverse	Neutral/Slight	Not significant
Wintering Birds								
Redshank, Gadwall, Pintail	High	Habitat loss	Short/ Medium/ Long term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant
Teal, Pocdhard, Shoveler	Medium	Habitat loss	Short/ Medium/ Long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Shelduck, Wigeon, Tufted duck, Curlew, lapwing, mallard	Low	Habitat loss	Short/ Medium/ Long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Other wintering bird species	Low	Habitat loss	Short/ Medium/ Long term	Minor Adverse	Neutral/Slight	Minor Adverse	Neutral/Slight	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Construction phase								
European Statutory Designated Sites	Very High	Disturbance, habitat loss	Long term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant
National Statutory Designated Sites	High	Disturbance, habitat loss	Medium term	Minor Adverse	Slight/ Moderate	Minor Adverse	Slight/ Moderate	Significant
			Long term	Minor Adverse	Slight /Moderate	Negligible Adverse	Slight	Not significant
Non-statutory Designated Sites	Medium	Habitat loss	Medium/ Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Nature Reserves (Newport Wetlands, Magor Marsh)	High	None	Medium term	No Change	Neutral	No Change	Neutral	Not significant
Nature Reserves (Great Traston Meadows)	Medium	Disturbance	Medium term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Rivers (Usk and Ebbw)								
Rivers	Medium (Ebbw)/ High (Usk)	Pollution	Medium term	Minor Adverse	Slight/ Moderate (River Usk) Slight (River Ebbw)	Minor Adverse	Slight/ Moderate (River Usk) Slight (River Ebbw	Significant
Sub-tidal benthic habitat	Medium (Ebbw)/ High (Usk)	Pollution	Medium term	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Intertidal mudflats	Medium (Ebbw)/ High (Usk)	Habitat loss, pollution	Medium term	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Not significant
Coastal saltmarsh	Medium (Ebbw)/ High (Usk)	Habitat loss	Medium term	Minor Adverse	Slight (River Ebbw) Slight/ Moderate (River Usk)	Minor Adverse	Slight (River Ebbw) Slight/ Moderate (River Usk)	Significant
			Long term	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Not significant
Migratory fish	Very High	Pollution	Medium term	Moderate Adverse	Large/Very Large	Negligible Adverse	Slight	Not significant
Estuarine migratory fish assemblage	High	Disturbance	Medium term	Moderate Adverse	Moderate/ Large	Negligible Adverse	Slight	Not significant
Reens, ditches, reedbeds and ponds								
Eutrophic standing waters	High	Pollution	Medium term	Minor Adverse	Slight/ Moderate	Minor Adverse	Slight/ Moderate	Significant
Ponds	Medium	Pollution	Medium term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Reedbeds	Medium	Habitat loss	Medium term	Moderate Adverse	Moderate	Moderate Adverse	Moderate	Significant
			Long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Aquatic macrophytes	High	Loss of species diversity	Medium term	Moderate Adverse	Moderate/ Large	Minor Adverse	Slight/ Moderate	Significant
Otter	High	Habitat loss, fatality, pollution, disturbance	Medium term	Moderate Adverse	Moderate/ Large	Minor Adverse	Slight/ Moderate	Significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Water vole	Medium	Habitat loss, pollution, disturbance	Medium term	Major Adverse	Moderate/ Large Adverse	Minor Adverse	Slight	Not significant
Grass snake	Medium	Habitat loss, disturbance	Medium term	Major Adverse	Moderate/ Large	Minor Adverse	Slight	Not significant
Great crested newt	Medium	Habitat loss, disturbance	Medium term	Major Adverse	Moderate/ Large	Minor Adverse	Slight	Not significant
Other amphibians	Low	Habitat loss, disturbance	Medium Term	Major Adverse	Slight/ Moderate	Moderate Adverse	Slight	Not significant
Freshwater fish assemblage	Medium	Pollution	Medium term	Minor Adverse	Slight	Negligible Adverse	Neutral/Slight	Not significant
European eel	Very High	Pollution	Medium term	Minor Adverse	Moderate/ Large	Negligible Adverse	Slight	Not significant
Freshwater invertebrates	High	Loss of species diversity	Medium term	Moderate Adverse	Moderate/ Large	Minor Adverse	Slight/ Moderate	Significant
Grazing Marsh								
Coastal and floodplain grazing marsh	High	Habitat loss	Medium term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant
Shrill carder bee	High	Habitat loss	Medium term	Moderate Adverse	Moderate/ Large	Moderate Adverse	Moderate/ Large	Significant
			Long term	Moderate Adverse	Moderate/ Large	Minor Adverse	Slight/ Moderate	Significant
Wet grassland plants	Medium	Loss of species diversity	Medium term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Farmland								
Lowland mixed deciduous woodland (Semi-natural)	Medium	Habitat loss	Medium term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Lowland mixed deciduous woodland (Plantation)	Low	Habitat loss	Medium term	Minor Adverse	Neutral/Slight	Minor Adverse	Neutral/Slight	Not significant
Hedgerows	Medium	Habitat loss	Medium term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Lowland meadow (Species-rich)	Medium	Habitat loss	Medium term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Lowland Meadow (other non-SSSI)	Low	Habitat loss	Medium term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Dormouse	Medium	Habitat loss	Medium term	Major Adverse	Moderate/ Large Adverse	Minor Adverse	Slight Adverse	Not significant
Badger	Low	Habitat loss	Medium term	Moderate Adverse	Slight	Minor Adverse	Neutral/Slight	Not significant
Hedgehog	Low	Habitat loss	Medium term	Major Adverse	Slight/ Moderate	Minor Adverse	Neutral/Slight	Not significant
Industrial land								
Open mosaic habitats on previously developed land	Medium	Habitat loss	Medium term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Reptiles (Common lizard, slow worm)	Low	Habitat loss	Medium term	Moderate Adverse	Slight	Minor Adverse	Neutral/Slight	Not significant
Terrestrial invertebrates	Medium	Habitat loss	Medium term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Bats	Medium	Habitat loss	Medium term	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Significant
Breeding Birds								
Ramsar site named species (Lesser black-	High	None	Medium term	No change	Neutral	No change	Neutral	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
backed gull, Herring gull)								
Cetti's warbler	High	Habitat loss, disturbance	Medium term	Moderate Adverse	Moderate /Large	Moderate Adverse	Moderate/ Large	Significant
Barn owl	Medium	Habitat loss, disturbance	Medium term	Moderate Adverse	Moderate	Minor Adverse	Slight	Not significant
Other species	Low	Habitat loss, disturbance	Medium term	Moderate Adverse	Slight	Moderate Adverse	Slight	Not significant
Wintering Birds								
Redshank, Gadwall, Pintail	High	Habitat loss, disturbance	Medium term	Minor Adverse	Slight/ Moderate	Minor Adverse	Slight/ Moderate	Significant
Teal, Pocdhard, Shoveler	Medium	Habitat loss, disturbance	Medium term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Shelduck, Wigeon, Tufted duck, Curlew, lapwing, mallard	Low	Habitat loss, disturbance	Medium term	Minor Adverse	Neutral/Slight	Minor Adverse	Neutral/Slight	Not significant
Other wintering bird species	Low	Habitat loss, disturbance	Medium term	Minor Adverse	Neutral/Slight	Minor Adverse	Neutral/Slight	Not significant
Operational Phase								
European Statutory Designated Sites	Very High		Long term	No change	Neutral	No change	Neutral	Not significant
National Statutory Designated Sites	High	Land management	Long term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Non-statutory Designated Sites	Medium	Disturbance	Long term	Moderate Adverse	Moderate	Minor	Slight	Not significant
Nature Reserves (Newport Wetlands, Magor Marsh)	High	None	Long term	No Change	Neutral	No Change	Neutral	Not Significant
Nature Reserves (Great Traston Meadows)	Medium	Disturbance	Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Rivers (Usk and Ebbw)								
Rivers	Medium (Ebbw)/ High (Usk)	Pollution, disturbance	Long term	Negligible Adverse (River Usk), Minor Adverse (River Ebbw)	Slight (River Usk), Slight (River Ebbw)	Negligible Adverse (River Usk), Minor Adverse (River Ebbw)	Slight (River Usk), Slight (River Ebbw)	Not significant
Sub-tidal benthic habitat	Medium (Ebbw)/ High (Usk)	Pollution	Long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Intertidal mudflats	Medium (Ebbw)/ High (Usk)	Pollution	Long term	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Not significant
Coastal saltmarsh	Medium (Ebbw)/ High (Usk)	Pollution	Long term	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Negligible Adverse	Neutral/Slight (River Ebbw) Slight (River Usk)	Not significant
Migratory fish	Very High	Pollution	Long term	Minor Adverse	Moderate/ Large	Negligible Adverse	Slight	Not significant
Estuarine migratory fish assemblage	High	Pollution	Long term	Minor Adverse	Slight/ Moderate	Negligible Adverse	Slight	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Reens, ditches, reedbeds and ponds								
Eutrophic standing waters	High	Severance, pollution	Long term	Minor Adverse	Slight/ Moderate	Negligible Adverse	Slight	Not significant
Ponds	Medium	Pollution	Long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Reedbeds	Medium	Pollution	Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Aquatic macrophytes	High	Pollution	Long term	Minor Adverse	Slight/ Moderate	Negligible Adverse	Slight	Not significant
Otter	High	Severance, pollution	Long term	Major Adverse	Large/Very Large	Minor Adverse	Slight/ Moderate	Significant
Water vole	Medium	Severance, pollution	Long term	Moderate Adverse	Moderate	Minor Adverse	Slight	Not significant
Grass snake	Medium	Severance, pollution	Long term	Moderate Adverse	Moderate	Minor Adverse	Slight	Not significant
Great crested newt	Medium	Severance, pollution	Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Other amphibians	Low/	Severance, pollution	Long term	Minor Adverse	Neutral/ Slight	Minor Adverse	Neutral/ Slight	Not significant
Freshwater fish assemblage	Medium/ High	Pollution	Long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
European eel	Very High	Pollution	Long term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant
Freshwater invertebrates	High	Pollution	Long term	Minor Adverse	Slight/ Moderate	Negligible Adverse	Slight	Not significant
Grazing Marsh								
Coastal and floodplain grazing marsh	High	Severance	Long term	Minor Adverse	Slight/ Moderate	Negligible Adverse/ Potentially Minor Beneficial	Slight	Not significant
Shrill carder bee	High	Severance, disturbance	Long term	Minor Adverse	Slight/ Moderate	Negligible	Slight	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Wet grassland plants	Medium	Severance	Long term	Minor Adverse	Slight	Negligible Adverse/ potentially Minor Beneficial	Neutral/Slight	Not significant
Farmland								
Lowland mixed deciduous woodland (Semi-natural)	Medium	Severance, disturbance	Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Lowland mixed deciduous woodland (Plantation)	Low	Severance, disturbance	Long term	Minor Adverse (potentially Moderate Beneficial)	Neutral or Slight,	Minor Adverse (potentially Moderate Beneficial)	Neutral or Slight,	Not significant
Hedgerows	Medium	Severance	Long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Lowland meadow (Species-rich)	Medium	Severance	Long term	Negligible Adverse	Neutral/Slight	No change	Neutral	Not significant
Lowland Meadow (Other non-SSSI)	Low	Severance	Long term	Negligible Adverse	Neutral/Slight	No change	Neutral	Not significant
Dormouse	Medium	Fatalities	Long term	Minor Adverse	Slight	Negligible Adverse	Neutral/Slight	Not significant
Badger	Low	Fatalities	Long term	Moderate Adverse	Slight	Minor Adverse	Neutral/Slight	Not significant
Hedgehog	Low	Disturbance	Long term	Moderate Adverse	Slight	Minor Adverse	Neutral/Slight Adverse	Not significant
Industrial land								
Open mosaic habitats on previously developed land	Medium	Severance/disturbance	Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Reptiles (Common lizard, slow worm)	Low	Severance	Long term	Minor Adverse	Neutral/Slight	Minor Adverse	Neutral/Slight	Not significant

Activity/ Receptor	Value of receptor	Description of impact	Short / medium / long term	Magnitude of impact (without mitigation)	Significance of effect (without mitigation)	Magnitude of impact (with mitigation)	Significance of effect (with mitigation)	Significant / Not significant In EIA terms
Terrestrial invertebrates	Medium	Severance	Long term	Minor Adverse	Slight	Minor Adverse	Slight	Not significant
Bats	Medium	Severance	Long term	Moderate Adverse	Moderate	Moderate Adverse	Moderate	Significant
Breeding Birds								
Ramsar site named species (Lesser black-backed gull, Herring gull)	High	Severance, disturbance	Long term	No change	Neutral	No change	Neutral	Not significant
Cetti's warbler	High	Severance, disturbance	Long term	Moderate Adverse	Moderate /large	Moderate Adverse	Moderate/ large	Significant
Barn owl	Medium	Severance, disturbance, vehicle strike	Long term	Moderate Adverse	Moderate	Minor adverse	Slight	Not significant
Other species	Low	Severance, disturbance	Long term	Moderate Adverse	Slight	Moderate Adverse	Slight	Not significant
Wintering Birds								
Redshank, Gadwall, Pintail	High	Severance, disturbance	Long term	Negligible Adverse	Slight	Negligible Adverse	Slight	Not significant
Teal, Pocdhard, Shoveler	Medium	Severance, disturbance	Long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Shelduck, Wigeon, Tufted duck, Curlew, lapwing, mallard	Low	Severance, disturbance	Long term	Negligible Adverse	Neutral/Slight	Negligible Adverse	Neutral/Slight	Not significant
Other wintering bird species	Low	Severance, disturbance	Long term	Minor Adverse	Neutral/Slight	Minor Adverse	Neutral/Slight	Not significant

10.12.11 Having considered both the mitigation which is integral to the Scheme, and also the proposed additional mitigation, the residual effects are summarised in this section.

European Statutory Designated Sites

Land Take

10.12.12 The only European designated site which would be affected by the land take for the Scheme would be the River Usk SAC where the east pylon of the River Usk crossing would be located within an area of saltmarsh. The saltmarsh would be replaced and saltmarsh is not one of the features for which the SAC is designated and there would thus be no loss of a key feature of the SAC. The magnitude of impact would be Negligible Adverse and the significance of effects Slight at all timescales. In EIA terms the effect would not be significant.

Construction

10.12.13 The magnitude of the impacts of the temporary land take for construction purposes is assessed as Negligible Adverse and the significance of effects Slight at all timescales. In EIA terms the effects would not be significant.

Operation

10.12.14 Since there would be no further physical incursions into the sites, there would be no operational effects on the designated sites *per se*. The magnitude of impact would thus be No Change and the significance of effects Neutral. This would not be significant in EIA terms.

National Designated Sites

Land Take

10.12.15 The east pier of the new crossing of the River Usk would be located within an area of saltmarsh on the east bank of the river. The mitigation included in the Scheme for this loss of saltmarsh is the creation of new saltmarsh in an area to be used for construction of the River Usk Crossing once the construction works are complete.

10.12.16 The new section of motorway would cross the Gwent Levels St Bride's SSSI, the Nash and Goldcliff SSSI, the Whitson SSSI and the Redwick and Llandevenny SSSI. The land take for the Scheme would have significant effects on the SSSIs. The new section of motorway would cross the River Usk (Lower Usk) SSSI which is also designated as an SAC as referred to above.

10.12.17 The maintenance of reen connections by culverting across the road and the replacement of infilled and culverted reens and infilled field ditches at a ratio of a little over 1:1 is integral to the design of the Scheme. The proposals for mitigation for the loss of grazing marsh within the SSSIs are set out in the SSSI Mitigation Strategy at Appendix 10.35.

10.12.18 Taking into account that this additional mitigation and enhancement would commence in advance of construction, and that improvements in the ecological interest of grasslands would be expected to be manifest within a few years, the magnitude of the land take impacts on the Gwent Levels SSSIs (National (High)

value) is assessed as Moderate Adverse and the significance of effects as Moderate or Large in the short term. The magnitude of impacts would be Minor Adverse and the Significance of effects Slight or Moderate in the medium/long term. Taking a precautionary approach the short, medium and long term effects on the Gwent Levels SSSIs would be significant in EIA terms.

Construction

10.12.19 The assessment takes into account the replacement of saltmarsh within the River Usk (Lower Usk) SSSI, which would be affected by the construction of the new River Usk Crossing, and which forms part of the Scheme design, construction land take within the Gwent Levels SSSIs which would be restored to grassland, together with the additional mitigation set out in the SSSI Mitigation Strategy (Appendix 10.35). The magnitude of the land take impacts would be Minor Adverse leading to effects of Slight or Moderate significance in the medium term. In the long term the magnitude of impacts would be Negligible Adverse and the significance of effects Slight. In EIA terms, taking a precautionary approach, the effects would be significant in the short and medium terms and not significant in the long term.

Operation

10.12.20 Some sections of Gwent Levels SSSIs to the north of the new section of motorway would be severed from the major parts of the designated sites to the south. All of the grazing marsh areas could continue to be managed alongside the operation of the Scheme. The magnitude of impacts on nationally designated sites (National (High) value) is assessed as Negligible Adverse and the significance of effects as Slight. This is not significant in EIA terms.

Non-statutory Designated Sites

Land Take

10.12.21 The land take for the new section of motorway would affect nine Sites of Importance for Nature Conservation (SINCs) and two areas of ancient woodland. Overall the magnitude of the impacts on the SINCs would be Major Adverse and the significance of effects Moderate or Large in the short term. The magnitude of impacts would be Moderate Adverse and the effects of Moderate significance in the medium and long term. In EIA terms the effects would be significant in the short, medium and long term.

Construction

10.12.22 There would be additional land take for construction within the Marshall's SINC (saltmarsh as described above for International and National Designated Sites and areas of industrial land of minimal ecological value) and areas of scrub within the Spencer Works 3 SINC. These effects would not be significant in EIA terms.

Operation

10.12.23 The operation of the new section of motorway would have little ongoing severance effect on SINCs and there would be no effects of highway drainage on the sites other than the drainage discharges to the River Ebbw SINC and to the St Bride's Brook within the Grange Road SINC. The proposals for mitigation for

the loss of grazing marsh set out in the SSSI Mitigation Strategy at Appendix 10.35 would result in creation of new grassland areas and improved management of existing grasslands and would also serve to mitigate for the operational impacts on SINCs. Taking into account this additional mitigation, the magnitude of the operational impacts on SINCs is assessed as Minor Adverse and the significance of effects as Slight. In EIA terms this would not be significant.

Nature Reserves

Land Take

10.12.24 Nature reserves in the vicinity of the new section of motorway are the Newport Wetlands NNR and RSPB Nature Reserve, and the Magor Marsh and Great Traston Meadows Gwent Wildlife Trust Nature Reserves. The Scheme would not result in land take from any of these nature reserves and there would be no significant land take effects.

Construction

10.12.25 Given their distance from the Scheme, adverse effects on the ecology of either Magor Marsh Nature Reserve or Newport Wetlands Nature Reserve as a result of construction activities are unlikely (No change). There could be some disturbance from construction in the north western part of Great Traston Meadows Nature Reserve (County (Medium) value). The impact is likely to be of Minor Adverse magnitude and the significance of effects Slight. These effects would not be significant in EIA terms.

Operation

10.12.26 Given their distance from the Scheme, adverse effects on the ecology of either Magor Marsh Nature Reserve or Newport Wetlands Nature Reserve as a result of the operation of the new section of motorway are unlikely (No change). There could be some disturbance from traffic in the north western part of Great Traston Meadows Nature Reserve (County (Medium) value). The impact is likely to be of Minor Adverse magnitude and the significance of effects Slight. This would not be significant in EIA terms.

Rivers (Usk and Ebbw) Ecological Unit

10.12.27 The Rivers (Usk and Ebbw) Ecological Unit includes the following VERS.

- Rivers.
- Sub-tidal benthic habitat.
- Intertidal mudflats.
- Coastal saltmarsh.
- Migratory fish.
- Estuarine fish assemblage.

10.12.28 The Newport Local BAP includes a Freshwater Habitat Action Plan, which in turn includes Rivers and Streams. The Trunk Road Estate BAP includes a Rivers and Streams Habitat Action Plan.

10.12.29 The major watercourses within the Scheme corridor are the Rivers Usk and Ebbw, both of which would be crossed by the new section of motorway. The river crossings have been designed to avoid any construction within the wetted channels of the rivers (which has been defined as within the limits of Mean High Water) in order to avoid any adverse effects on the river habitat.

10.12.30 The Newport Local BAP includes a Marine and Coastal Habitat Action Plan. This includes a section on Coastal Saltmarsh. The Trunk Roads Estate BAP includes a Habitat Action Plan for Coastal and Estuarine Habitats which includes saltmarshes. The Scheme would result in the permanent loss of 0.2 ha of saltmarsh on the east bank of the River Usk through the land take for the east pylon of the River Usk Crossing. There would also be permanent loss of some 0.74 ha of saltmarsh on the banks of the River Ebbw through a combination of land take for the bridge supports and shading by the new bridge which would be much lower than the River Usk Crossing. Saltmarsh on the east bank of the River Usk temporarily used for construction purposes would be reinstated on completion of construction. In order to mitigate for the permanent loss of the total of 0.94 ha of saltmarsh, a new area of saltmarsh would be established on the site of the construction compound to the south of the proposed River Usk Crossing on the east bank of the River Usk. This would cover some 2 ha, giving a ratio of new saltmarsh to that which would be permanently lost of 2.1:1.

10.12.31 The Trunk Roads Estate BAP Habitat Action Plan for Coastal and Estuarine Habitats also includes Mudflats. As explained above the crossings of the rivers Usk and Ebbw would avoid the wetted channels of the rivers, which includes the intertidal mud.

Land Take

10.12.32 In EIA terms the residual effects of land take on all these VERs would not be significant other than for coastal saltmarsh, the effects on which, as explained under International Designated Sites above, taking a precautionary approach, in the medium term would be significant, and in the long term not significant.

Construction

10.12.33 In EIA terms the residual effects of construction on sub-tidal benthic habitats, intertidal mudflats, migratory fish and estuarine fish would not be significant.

10.12.34 For the rivers habitat, taking into account the mitigation measures which are incorporated into the Scheme to minimise the risk of accidental pollution events and particulate pollution during construction (i.e. avoidance of construction in the wetted channel of the rivers (defined as the channel below Mean High Water as explained in Chapter 2: Scheme Description), the CEMP following the principles set out in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), and the Outline Ground and Surface Water and Groundwater Management Plan (Annex G to Appendix 3.2), and adherence to standard best practice guidance and Environment Agency Pollution Prevention Guidelines) the magnitude of the impacts is assessed as Minor Adverse and the significance of effects as Slight or Moderate for the River Usk (National (High) value) and Slight for the River Ebbw (County (Medium value). Taking a precautionary approach, the effect on the River Usk in EIA terms is a medium term significant effect. The effect on the River Ebbw is not significant.

10.12.35 The magnitude of the impact of construction on coastal saltmarsh habitats has been described above under International and National Designated Sites. It would be Minor Adverse in the medium term and the significance of effects Slight for saltmarsh at the River Ebbw (receptor of Medium value) and Slight or Moderate for saltmarsh at the River Usk (receptor of High value). In the long term the magnitude of impacts would be Negligible Adverse and the significance Neutral or Slight for the River Ebbw saltmarsh (County (Medium) value) and Slight for the River Usk saltmarsh (National (High) value). In EIA terms the medium term effect on the River Usk saltmarsh would be significant. The other effects would not be significant.

Operation

10.12.36 The incorporation of the drainage strategy as a key aspect of the Scheme design is considered to provide a comprehensive means by which to protect the Rivers Usk and Ebbw and associated habitats and species from contaminants associated with the routine highway runoff and pollution events. Measures to avoid the bridge lighting illuminating the rivers are also proposed to avoid adverse effects of lighting on fish.

10.12.37 In EIA terms the residual effects of the operation of the new section of motorway on the habitats and species included in the Rivers Ecological Unit would not be significant.

Reens, Ditches, Reedbeds and Ponds Ecological Unit

10.12.38 The Reens, ditches, reedbeds and ponds Ecological Unit includes the following VERS.

- Eutrophic standing waters.
- Ponds.
- Reedbeds.
- Aquatic macrophytes.
- Otter.
- Water vole.
- Grass snake.
- Great crested newt and other amphibians.
- Freshwater fish assemblage.
- Freshwater invertebrates.

10.12.39 The Newport Local BAP includes a Wetland Habitat Action Plan which in turn includes Coastal and Floodplain Grazing Marsh with the associated reens and ditches, and Reedbeds. The Trunk Road Estate BAP also includes a Waterbodies Habitat Action Plan, which includes Ponds.

10.12.40 The Scheme would result in the infilling or culverting of 2568 m of reens and 9136 m of field ditches. To mitigate for this, the proposals include the provision of 2657 m of new reens and 9771 m of new field ditches.

10.12.41 No ponds would be lost under the footprint of the new section of motorway itself but a pond would be lost at the Duffryn construction compound site. A total of 6.59 ha of reedbed would be affected during the construction of the new section of motorway of which 3.19 ha would be taken for the permanent works and 3.35 ha would be temporarily used during the construction period and then returned to reedbed.

10.12.42 New water treatment areas including ponds and reedbeds would be constructed along the length of the Scheme, 9.4 ha of which would comprise ponds and 8.06 ha of which would comprise reedbeds.

10.12.43 Otter is included in the Newport Local BAP. The Trunk Road Estate BAP includes a species action plan for Otter. The Newport Local BAP species action plan for water vole states that a major objective is to enhance and create suitable habitat to re-establish links within its range along the coastal floodplains and restore water vole populations to these areas. The Trunk Road Estate BAP includes a species action plan for water vole. The Trunk Road BAP includes a species action plan for amphibians.

10.12.44 Design of the Scheme has taken into account the need to ensure that these wetland species are protected during the construction of the new section of motorway, and once completed can continue to occupy suitable habitats in the vicinity, and in particular are able to cross the line of the new section of motorway so as to avoid isolation of populations.

Land Take

10.12.45 In EIA terms the residual effects of land take on all these VERs would be not significant other than for reedbeds and freshwater invertebrates. The magnitude of impacts from land take on reedbeds is assessed as Moderate Adverse and the significance of effects as Moderate in the short term. In the medium term as the new reedbeds established the magnitude of impacts would be Negligible Adverse and the significance of effects Neutral or Slight. In EIA terms the effects in the short term would be significant, and in the medium term would not be significant.

10.12.46 For freshwater invertebrates the magnitude of the impacts of land take would be Minor Adverse and the significance of effects Slight or Moderate in the short term, and in the medium/long term, the impacts would be Negligible Adverse and the significance of effects Slight. In EIA terms the effects in the short term would be significant, and in the medium term would not be significant.

Construction

10.12.47 In EIA terms the residual effects of construction on ponds, water vole, grass snake, great crested newt and other amphibians, and freshwater fish would not be significant.

10.12.48 The magnitude of the impact of construction works on eutrophic standing waters taking account of the pollution control and other water management measures included in the Scheme and described in the Pre-CEMP (Appendix 3.2), the Outline Pollution Control and Prevention Plan (Annex E to Appendix 3.2), and the Outline Ground and Surface Water and Groundwater Management Plan (Annex G to Appendix 3.2) is assessed as Minor Adverse and the significance of effects as Slight or Moderate. In EIA terms, and taking a precautionary approach, this is a significant medium term effect.

10.12.49 For reedbeds, the magnitude of the residual impact of the construction works on reedbeds, taking into account that the reedbed affected during the construction period would be restored on completion, is assessed as Moderate Adverse and the significance of effects as Moderate in the medium term. In the long term as the new reedbeds established the magnitude of impacts would be Negligible Adverse and the significance of effects Neutral or Slight. In EIA terms there would be a medium term significant effect.

10.12.50 The magnitude of the residual impact of the construction works on aquatic macrophyte assemblages, taking account of the pollution control measures which would be implemented as part of the Scheme as referred to above, and additional measures to limit changes in reen and ditch water levels during construction is assessed as Minor Adverse and the significance of effects as Slight or Moderate. Taking a precautionary approach, in EIA terms this is a significant medium term effect.

10.12.51 For otter, taking into account the measures to limit the potential for and likely impact of pollutants, the commitment to culvert retained reens, and the planting and creation of replacement and new habitats of value to otters (including woodland, scrub, hedgerows and reedbeds) as shown on the EMP (Figure 2.6), and additional mitigation measures, in particular pre-construction surveys, the installation of mammal exclusion fencing around boundaries of the work sites, provision of mammal crossings, and species-sensitive design of culverts, the magnitude of the likely impact of construction on otters is assessed as Minor Adverse and the significance of effects as Slight or Moderate. Taking a precautionary approach, In EIA terms this is a medium term significant effect.

10.12.52 For freshwater invertebrates, the mitigation measures that would be implemented to protect water quality would reduce the risk from pollution. Additional mitigation measures would manage water levels during construction. The magnitude of the residual impacts would be Minor Adverse and the significance of effects Slight or Moderate. Taking a precautionary approach, this would be a medium term significant effect.

Operation

10.12.53 In EIA terms the residual effects of the operation of the new section of motorway would not be significant on all habitats and species included in the Reens, Ditches, Reedbeds and Ponds Ecological Unit, other than for otter and freshwater invertebrates.

10.12.54 The magnitude of the operational impact of the new motorway on otter, taking into account the installation of mammal exclusion fencing around the boundaries of the new road and measures to limit the potential for and likely impact of operational pollutants included in the Scheme, and additional mitigation measures, in particular the provision of mammal crossings, and mammal tunnels at all culverted reens, is assessed as Minor Adverse and the significance of effects Slight or Moderate. Taking a precautionary approach, in EIA terms the effect would be significant.

Grazing Marsh Ecological Unit

10.12.55 The Grazing marsh Ecological Unit includes the following VERS.

- Coastal and floodplain grazing marsh.

- Shrill carder bee.
- Wet grassland plants.

10.12.56 The Newport BAP includes a Wetland Habitat Action Plan which includes Coastal and Floodplain Grazing Marsh. The Monmouthshire BAP includes a Habitat Action Plan for Species-rich grasslands and Floodplain Pastures including Seasonally Flooded Pastures. The Trunk Roads Estate BAP includes a Habitat Action Plan for Coastal and Estuarine Habitats which in turn includes Coastal and floodplain grazing marsh. The Scheme would result in the unavoidable loss of some 86.4 ha of grazing marsh within the Gwent Levels SSSIs (of which 77.6 ha would be permanently lost and 8.85 ha would be within the temporary construction areas). In order to mitigate for this loss the SSSI Mitigation Strategy (Appendix 10.35) provides for a range of habitat improvements across up to 155 ha of land at Maerdy Farm, Tatton Farm and Caldicot Moor.

10.12.57 The shrill carder bee is also a Newport BAP species recognising that one of the remaining populations of this species is on the flower-rich grasslands of the Gwent Levels SSSIs. Loss of habitat for shrill carder bee would arise from the loss of the vegetation bordering reens and ditches, and the loss of vegetated brownfield land at Great Pencarn, land within Newport Docks and the Tata Steel site. Mitigation for the loss of reens and ditches is described under the Reens, ditches, reedbeds and ponds Ecological Unit above. Other habitat for shrill carder bee would be provided on south facing embankments and cuttings of the new section of motorway which would include areas to be sown to species-rich grassland. Extensive areas of species-rich grassland would be established on south facing cutting slopes at the Castleton Interchange in the west of the new section of motorway and on the embankments of water treatment areas. Additional mitigation would be provided by the SSSI Mitigation Strategy (Appendix 10.35) which would include measures to improve the species diversity of existing grasslands, to create new species-rich grassland on areas which are currently arable land, to enhance the biodiversity of existing reen and ditch banks, and to create new ditches, with associated bank vegetation, all of which would be of benefit to shrill carder bee. The construction sites at Great Pencarn, within Newport Docks and at Tata Steel, would be restored so far as practicable, to provide a mosaic of habitats including areas with food plant species of value to shrill carder bee.

Land Take

10.12.58 In EIA terms there would be significant effects of land take on these VERs as follows.

10.12.59 Taking into account the extent of the loss of coastal and floodplain grazing marsh habitat, and the strategy to mitigate the effects of loss of grazing marsh described in the SSSI Mitigation Strategy (Appendix 10.35), the magnitude of the impacts on the habitat in the short term are assessed as Moderate Adverse and the significance as Moderate or Large, and in the medium to long term, the magnitude of impacts would be Minor Adverse and the effects of Slight or Moderate significance. In EIA terms, taking a precautionary approach, the effects would be significant in the short, medium and long term.

10.12.60 The magnitude of the impacts on shrill carder bee, taking into account the mitigation comprising the habitat creation included in the Environmental

Masterplans (Figure 2.6), the improvements included in the SSSI Mitigation Strategy (Appendix 10.35) and the sympathetic restoration of the construction sites at Great Pencarn, Newport Docks and Tata Steel would be Moderate Adverse and the significance Moderate or Large in the medium term. In the long term as the new and replacement habitats develop, the magnitude of impacts would be Minor Adverse and the significance of effects Slight or Moderate. In EIA terms, taking a precautionary approach, the effects would be significant in the medium and long term.

10.12.61 For wet grassland plants, taking into account the extensive creation of suitable habitat which would result from implementation of the SSSI Mitigation Strategy (Appendix 10.35), the magnitude of impact would be Moderate Adverse and the effects of Moderate significance in the short term. In the medium term, as the habitat improvements take effect, the magnitude of impacts is assessed as Minor Adverse and the effects of Slight significance. In EIA terms the effects would be significant in the short term, becoming not significant in the medium term.

Construction

10.12.62 The residual effects of construction on coastal and floodplain grazing marsh and wet grassland plants would not be significant in EIA terms.

10.12.63 For shrill carder bee, the magnitude of impacts of the construction works resulting in additional habitat loss, taking into account the sympathetic restoration of the construction areas in Newport Docks and Tata Steel on completion of the works, is assessed as Moderate Adverse and the significance of effects Moderate or Large in the medium term and the magnitude of impacts Minor Adverse and the significance of effects Slight or Moderate in the long term. Taking a precautionary approach these effects are significant in EIA terms.

Operation

10.12.64 The residual effects of the operational motorway on the habitat and species included in the Grazing Marsh Ecological Unit, taking into account habitat severance, and that provisions would be made for NRW to manage the future drainage, the mitigation measures included in the Scheme and shown on the Environmental Masterplan (Figure 2.6), ongoing management of the new species-rich grasslands included in the Scheme, and the implementation of the SSSI Mitigation Strategy (Appendix 10.35) which would provide ecological enhancement of existing areas of grazing marsh and conversion of arable land to grazing marsh, would not be significant in EIA terms.

Farmland Ecological Unit

10.12.65 The Farmland Ecological Unit includes the following VERS.

- Lowland mixed deciduous woodland (including) wet woodland).
- Hedgerows.
- Lowland meadow.
- Dormouse.
- Badger.
- Hedgehog.

10.12.66 The Newport, Monmouthshire and Trunk Road Estate Biodiversity Action Plans (BAP) all include Woodland Habitat Action Plans. The total loss of woodland habitat as a result of the land take for the new section of motorway (including that within temporary construction areas) would be 49.8 ha (of which 7.15 ha is semi-natural woodland and 42.65 ha plantation). Acknowledging that the Scheme would result in unavoidable losses of woodland (much of which is plantation woodland associated with the existing M4, particularly in the Castleton area), the Scheme includes extensive woodland planting. The new planting comprises 103 ha of 'Woodland' and 'Linear Belts of Trees and Shrubs' similar to those associated with the existing M4. Unlike the existing woodland, there would be extensive new woodland blocks at Berryhill Farm in the west, and east of Rockfield Farm at Undy in the east. The overall ratio of new planting to that which would be lost would be 2.1:1. The long term management of these woodlands would be the responsibility of the South Wales Trunk Road Agent and would follow the principles set out in the Trunk Roads Estate BAP, including that of maximising biodiversity within woodlands.

10.12.67 The Newport Local BAP includes a Farmland Habitat Action Plan, which includes hedgerows. The Monmouthshire Local BAP includes a Boundary and Linear Features Habitat Action Plan. This includes hedgerows. The Trunk Road Estate BAP includes a Habitat Action Plan for Boundary Features, which includes hedgerows. The Scheme would result in the loss of some 35.8 km of hedgerows. The proposals include the planting of some 3.6 km of hedgerows. Much of the route of the new section of motorway would be through the Gwent Levels. Whilst the hedgerows within the Levels, typically along the reens and ditches which form the field boundaries, are of biodiversity value, NRW also consider them to be detrimental to the ecology of the reens and ditches which support the important aquatic plant and animal communities which are key features of the Gwent Levels SSSIs as they cause shading and interfere with management of the watercourses. NRW have thus indicated that hedgerow planting would not be appropriate within the Gwent Levels SSSIs. At either end of the Scheme, the extensive woodland and other landscape planting proposed at the Castleton and Magor Interchanges means that there would be little opportunity for hedgerow planting in these areas.

10.12.68 The Newport Local BAP includes a Lowland Grassland and Heathland Action Plan. This in turn includes Lowland Meadows. The Newport Local BAP also includes a Fungi Action Plan. This is primarily concerned with waxcaps and other grassland fungi. As referred to above under Coastal and Floodplain Grazing Marsh, the Monmouthshire Local BAP includes a Habitat Action Plan for Species-rich Grasslands and Floodplain Pastures. This includes Lowland Neutral Grassland. The Trunk Roads Estate BAP includes a Lowland Meadows Habitat Action Plan. Whilst the Scheme would result in the loss of some 164 ha of grassland in addition to that included under grazing marsh considered above, the majority of this is semi-improved or improved grassland of little intrinsic nature conservation value. Overall, the Scheme would result in the loss of some 7.01 ha of unimproved grassland. Some small areas of species-rich grassland including wax caps at Pound Hill and Pwll Diwaelod would be lost. The Scheme includes the establishment of some 26.1 ha of species-rich grassland, predominantly on the south facing embankments of the new motorway, and on the south facing slopes of cuttings, and on the banks enclosing the water treatment areas. The total area of all grassland (excluding amenity grassland) included in the Scheme is some 117 ha.

10.12.69 Dormouse is included in the Newport Biodiversity Action Plan. The Trunk Road Estate BAP includes a species action plan for dormouse. The main area for dormouse within the Scheme corridor is around the Castleton Interchange at the west of the Scheme with a smaller population north of Magor at the east. Two dormouse nests were found within the Gwent Levels south of the Tata Steel area. In the long term, replacement woodland planting would result in an increase in habitat of potential value to dormice throughout the Scheme (103 ha of woodland and linear belt planting as shown on the EMP (Figure 2.6) to replace 49.8 ha of loss). However, hazel dormice would require replacement habitat with immediate effect. Therefore, the mitigation for the Scheme would include dormouse trapping and translocation to a favourable off-site location in accordance with a European Protected Species licence and associated method statement. Investigations of potential receptor sites are progressing in consultation with NRW. Should no favourable off-site receptor site be located prior to the commencement of construction, with NRW approval and licencing, dormice would be trapped and translocated prior to construction to a temporary holding site in order to be cared for in captivity until an off-site receptor site has been enhanced to favourable condition or replacement planting associated with the Scheme has established and developed sufficiently to support the dormouse population in the long term. In principle agreement has been reached with Bristol Zoo regarding accommodation of a captive population of dormouse until such time as they can be released, if such a facility is required.

Land Take

10.12.70 The residual effects of land take on dormouse, badger and hedgehog would not be significant in EIA terms.

10.12.71 In EIA terms there would be significant effects of land take on other VERs as follows.

10.12.72 Within the lowland mixed deciduous woodland habitat, the effects on plantation woodland in EIA terms would not be significant and in the long term would be potentially beneficial. The magnitude of the impacts on semi-natural woodland would be Major Adverse leading to effects of Moderate or Large significance in the short and medium terms, but in the longer term the magnitude of impacts would be Moderate Adverse and the effects of Moderate significance. In EIA terms the effects would be significant in the short, medium and long term.

10.12.73 The magnitude of the loss of hedgerows as a result of the land take for the new section of motorway would be Moderate Adverse and the significance of effects Moderate in the short, medium and long term. In EIA terms this would be a significant impact. However, it must be appreciated that the woodland and linear planting at Castleton and Magor at either end of the Scheme would provide habitats of greater biodiversity value and would provide wildlife corridors, that NRW do not favour hedgerow planting by way of mitigation within the Gwent Levels SSSIs due to their potential to overshadow and impact upon the reens.

10.12.74 For lowland meadows, excluding coastal grazing marsh considered under the Grazing Marsh Ecological Unit above, the effects on all grasslands, other than species-rich grasslands, would not be significant in EIA terms. For species-rich grasslands the magnitude of impacts would be Moderate Adverse and the effects of Moderate significance in the short term. In the medium term as the new grassland develops the magnitude of impacts would be Minor Adverse and the

effects of Slight significance. In EIA terms the effects would be significant in the short term becoming not significant in the medium term.

Construction

10.12.75 The residual effects of construction on all VERs within the Farmland Ecological Unit would not be significant in EIA terms.

Operation

10.12.76 Taking into account the severance already caused by existing roads, the planting included in the Scheme which is shown on the EMP (Figure 2.6), future management of land within the highway boundary in accordance with the objectives of the Trunk Road Estate BAP, measures to limit the potential for and likely impact of light spill, the long term management and maintenance of habitats of potential value to dormice or the dormice receptor site(s), the long-term monitoring of dormice populations, the maintenance of box culverts and mammal crossings, the provision of mammal exclusion fencing around the operational boundary of the new road and the use of fencing to help guide wildlife into box culverts and dry mammal crossings, the residual effects of the operation of the new section of motorway on the habitats and species included in the Farmland Ecological Unit would not be significant in EIA terms.

Industrial Land Ecological Unit

10.12.77 The Industrial Land Ecological Unit includes the following VERS.

- Open mosaic habitats on previously developed land.
- Reptiles (Common lizard, slow worm).
- Terrestrial invertebrates.

10.12.78 The Newport Local BAP includes a Brownfield and Urban Action Plan, which in turn includes open mosaic habitats on previously developed land. The Monmouthshire Local BAP includes a Built Environment and Associated Green Spaces Habitat Action Plan, which in turn includes Wasteground, 'Brownfield' and Industrial Sites. Areas of 'brownfield' land which would be affected by the Scheme are at Great Pencarnn, south of the Solutia works, in Newport Docks, south of the Tata Steelworks at Llanwern, and at Green Moor. Vegetation on the brownfield land typically comprises a mosaic of grassland and scrub often formed on man-modified substrata.

10.12.79 The brownfield site at Great Pencarn would be almost entirely taken up by the main construction compound for the Scheme. In the section of Newport Docks between the River Ebbw and the River Usk, much of the vegetated brownfield land would be taken up by the embankment for the new section of motorway from the River Ebbw eastwards to the start of the viaduct section, by the link to Docks Way and its junction with the new section of motorway, or by temporary construction areas south of the embankment and east of the Docks Way link.

10.12.80 East of the River Usk there would be losses of areas of vegetated brownfield land adjacent to the saltmarsh on the east bank of the river, either side of the Uskmouth railway line, south of the Solutia works, and an area between the Uskmouth railway line and the River Usk in order to provide construction areas for the viaduct and Usk crossing.

10.12.81 The section of new motorway along the south of the Tata Steel land and across Green Moor, and the associated construction areas, would pass through brownfield land including sludge lagoons and their embankments.

10.12.82 In restoring the construction sites at Great Pencarn, within Newport Docks and Tata Steel, so far as practicable a mosaic of habitat types providing some of the characteristics of brownfield land would be provided. Such habitats include areas of unvegetated, loose bare substrate and pools and early successional communities consisting mainly of stress-tolerant species (e.g. indicative of low nutrient status or drought) which may be composed of annuals, mosses and liverworts, lichens, ruderals, inundation species, and open and flower-rich grassland. Hibernacula for reptiles, potentially using suitable surplus materials derived from construction would be provided.

10.12.83 The Trunk Road Estate BAP includes a species action plan for reptiles. Single common lizards were recorded at the eastern edge of Magor Services and the former laboratory site at Pye Corner in 2014 indicating low populations in these areas. In 2015 single common lizard and slow worm were recorded within Newport Docks indicating low populations. Prior to commencement of construction in areas where common lizard and slow worm populations have been identified, reptile fencing would be installed and reptiles would be captured and transferred to suitable habitat on the margin of the Scheme, or to suitable habitat within the SSSI mitigation areas (Appendix 10.35), or elsewhere by agreement.

10.12.84 The small ranunculus moth, recorded within the Tata Steel land, is the subject of a Species Action Plan in the Newport Biodiversity Action Plan. Brownfield sites are important for the recovery of this and other invertebrate species. Surveys of the land within Newport Docks identified 329 invertebrate species. Of these, 32 (9.7%) were considered to be 'Key Species', seven of them of Red Data Book or equivalent status. This represents a good diversity for such an open site. One species, a fly *Liriomyza intonsa,* is new for Britain. The survey showed that the saltmarsh beside the River Ebbw is of particular conservation importance.

10.12.85 Surveys of the land at and Tata Steel recorded 378 invertebrate species. Of these, 31 (8.2%) were considered to be 'Key Species', nine of them of Red Data Book or equivalent status (2.4%). This is a good diversity for the habitat types present. The proportion of Key Species was good, indicating an area of significant invertebrate conservation value. Of particular interest were a fly *Hydrophorus viridis* and a hoverfly *Sphaerophoria loewi*, both very rare nationally. Reens and ephemeral pools were particularly important for the rarest species found. Reedbeds and sedge beds were also important for a number of scarce species and general biodiversity. Old poplar trees were also of interest. Sympathetic restoration of the construction sites would partially mitigate for the loss of habitat for invertebrates characteristic of brownfield sites.

Land Take

10.12.86 The residual effects of land take on reptiles would not be significant in EIA terms.

10.12.87 For the open mosaic habitats on previously developed land habitat the magnitude of the land take impacts, taking into account the sympathetic restoration of the land at Great Pencarn, Newport Docks and Tata Steel, is assessed as Major Adverse and the significance of effects Moderate or Large in the medium term,

and the magnitude of impacts Moderate Adverse and the significance of effects Moderate in the long term. These effects are significant in EIA terms.

10.12.88 The magnitude of the impacts on the terrestrial invertebrate assemblage associated with brownfield land, taking into account the sympathetic restoration of the land at Great Pencarn, Newport Docks and Tata Steel, is assessed as Major Adverse and the significance of effects Moderate or Large in the medium term. In the long term as the habitats recovered the magnitude of impacts would be Moderate and the significance of effects Moderate. These effects would be significant in EIA terms.

Construction

10.12.89 The land take for construction has been assessed above. The residual effects of construction on all VERs within the Industrial Land Ecological Unit would not be significant in EIA terms.

Operation

10.12.90 The residual effects of the operation of the new section of motorway on the habitat and species included in the Industrial Land Ecological Unit, taking into account the sympathetic restoration of the construction areas at Great Pencarn, Newport Docks and Tata Steel, and the extent of habitat (particularly species-rich grassland) included in the Scheme and shown on the EMP (Figure 2.6), would not be significant in EIA terms.

Bats

10.12.91 There is a species action plan for bats in the Newport Local BAP. The Trunk Road Estate BAP includes a species action plan for bats. Recognising that all bats are European Protected Species and taking the results of the 2014 and 2015 reports together, the corridor of the proposed new section of motorway 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 for bats.

10.12.92 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 licenceable works. A bat barn would be provided north of Magor and another, if required, at Berryhill Farm. Artificial bat roost boxes to replace roosts which would be removed for the Scheme would be installed in suitable trees in field boundaries on the edges of the Scheme such as on the margins of construction sites and borrow pits, and elsewhere by agreement.

10.12.93 Habitats of value to bats which would be lost would include woodland, reens and their rough grassland banks, and hedgerows. The Scheme includes woodland and linear belt planting, and scrub planting. Reens and ditches would be constructed to replace the lost watercourses. There would be some hedgerow planting. Culverts and mammal tunnels, underpasses and overbridges, would provide routes which bats could use to 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.

Land Take

10.12.94 Taking into account the provision of a bat barn at Magor, the provision of bat boxes, minimising of light spill from the highway lighting where provided, provision of mammal crossings which could be used by some bat species, and design of planting to guide bats to culverts the magnitude of the impact of habitat loss with mitigation on bats is assessed as Moderate Adverse and the significance of effects Moderate in the short and medium terms. In the longer term the magnitude of impacts would be Minor Adverse and the effects of Slight significance. In EIA terms the short and medium term effects would be significant, but the long term effects not significant.

Construction

10.12.95 It is likely that there would be some changes in bat activity while crossing points are constructed and until bats locate these, but measures would be implemented to help bats locate these features, including locating them at or close to sites of high and very high bat activity, and the installation of mammal fencing and bat corridors. However, 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 predict exactly.. Other mitigation measures would include the use of sympathetic lighting and monitoring surveys. It is also the case that there is alternative habitat in the immediately surrounding area. The magnitude of the residual impact of construction on bats is assessed as Moderate Adverse and the effects of Moderate significance. In EIA terms this is a significant medium term effect.

Operation

10.12.96 Taking into account the potential risk of vehicle collision for some species which may cross the new section of motorway, and the long term disruption to the movement of all bat species but in particular those species unlikely to cross the new section of motorway, and the additional mitigation measures, 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 fencing and the location of planting to lead bats to safe crossing points, on a precautionary basis the magnitude of the residual impact on bats is assessed as Moderate Adverse and the significance of effects as Moderate. In EIA terms this would be significant.

Breeding Birds

10.12.97 The Trunk Road Estate BAP includes a species action plan for barn owl, the objectives of which are to gather more information about the presence of barn owls on the trunk road network, and to reduce the level and incidence of mortality on roads whilst managing the soft estate for barn owls where it is safe to do so, and where the risk of road-related casualties is low.

10.12.98 Barn owl is known to be susceptible to collision with moving vehicles due to its horizontal hunting techniques. Because barn owls remain relatively safe when confining their activities to road verges themselves it is recommended that these

linear stretches of rough grassland should be continuous and not interrupted by the planting of long impenetrable blocks of dense trees or shrubs which extend the full width of the verge. The landscape provisions for the Scheme provide linear grassland habitat along the proposed motorway verges through the Gwent Levels. The vegetated verges on a motorway are separated from the carriageways by the hard shoulder which provides a buffer between the potential barn owl feeding habitat and the traffic on the road. There would also be an area of marshy grassland south of the road at chainage 17900 to chainage 19100 in the vicinity of the existing potential barn owl nest, and nest boxes which would be provided during the construction phase, which would be an attractive hunting area for barn owl.

Land Take

10.12.99 The mitigation and other measures included in the Scheme which would be of benefit to breeding birds include replacement of reens and ditches (as set out in the Reen Mitigation Strategy at Appendix 2.3), the extensive woodland planting included in the Scheme (Figure 2.6) and the provision of water treatment areas incorporating ponds and reedbeds. Additional mitigation would be provided as set out in the SSSI Mitigation Strategy at Appendix 10.35 which would comprise the ecological enhancement of land at Maerdy Farm, Tatton Farm and Caldicot Moor.

10.12.100 The effects on the breeding bird components of the Severn Estuary SPA or Ramsar site would not be significant in EIA terms, as would be the effects on other breeding birds apart from barn owl and Cetti's Warbler.

10.12.101 For barn owl the magnitude of the short term impacts of land take would be Moderate Adverse and the significance of effects Moderate, but in the medium term, as the improvements to the SSSI mitigation areas became effective, the magnitude of land take impacts would be Negligible Adverse and the significance of effects Neutral or Slight. The short term effects would be significant in EIA terms, becoming not significant in the medium term.

10.12.102 The predicted magnitude of impact for Cetti's warbler with respect to land take would be Moderate Adverse and the effects of Moderate or Large significance in the short term, but Minor Adverse in the medium and long term and the significance of effects Slight or Moderate. Taking a precautionary approach, these effects would be significant in EIA terms.

Construction

10.12.103 In EIA terms the effects on the breeding breeding components of the Severn Estuary SPA or Ramsar sites, and for other breeding birds (including barn owl) other than Cetti's Warbler, would not be significant. For Cetti's warbler, the magnitude of the impacts would be Moderate Adverse and the significance of effects Moderate or Large. In EIA terms this would be a significant medium term effect.

Operation

10.12.104 In EIA terms the operation of the new section of motorway would have no significant effect on the breeding bird components of the Severn Estuary SPA or Ramsar site.

10.12.105 Taking into account the ongoing management of the new reens and water treatment areas which would develop as suitable habitat for Cetti's warbler and other wetland breeding birds, the management of the extensive woodland and other planting included in the Scheme as shown on the EMP (Figure 2.6) which would provide extensive habitat for woodland birds, and the habitat which would be provided by the SSSI mitigation areas, the magnitude of the residual impacts of the operation of the new section of motorway on Cetti's warbler would be Moderate and the significance of effects Moderate or Large. This would be a significant effect in EIA terms.

10.12.106 For other breeding bird species identified in the study area, the residual effects of the operation of the new section of motorway would not be significant in EIA terms.

Wintering Birds

Land Take

10.12.107 The residual effects of land take on wintering birds would not be significant in EIA terms.

Construction

10.12.108 Taking account of the potential disturbance effects at the river crossings, the magnitude of impact on wintering birds is assessed as Minor Adverse. Therefore, with respect to construction, the significance of effect for the wintering birds that are part of the Severn Estuary SPA/Ramsar site would be Slight or Moderate for species of National (High) value (redshank, gadwall and pintail), Slight for species of County (Medium) value (teal, pochard and shoveler), Neutral or Slight for species of District (Low) value (shelduck, wigeon, tufted duck, curlew, lapwing and mallard), and Neutral or Slight for the other species that make up part of the Severn Estuary SPA/Ramsar assemblage.

10.12.109 In EIA terms, and on a precautionary basis, the effect on wintering birds that are part of the Severn Estuary SPA/Ramsar site would be significant in the medium term. The other effects would not be significant.

10.12.110 For other species recorded within the study area the effects would not be significant in EIA terms.

Operation

10.12.111 The residual effects of the operation of the new section of motorway, taking into account disturbance (visual and noise), the risk of vehicle collisions, and the availability of alternative habitat would not be significant.