7 Biodiversity

7.1 Introduction

7.1.1 This chapter of the Environmental Statement (ES) assesses the likely significant effects of the proposed development on ecological/biodiversity features[1] within the planning boundary and surrounding environments.

7.1.2 This chapter documents survey work undertaken in relation to habitats and species, the value of receptors identified and the predicted effects arising from the construction and operation of the proposed development. The chapter also documents measures to mitigate for these effects. Enhancement measures, where deemed necessary in relation to legislative and policy drivers, which go beyond mitigating effects are also identified. The residual effects following the inclusion of these measures are then assessed.

7.2 Review of proposed development

7.2.1 The proposed development comprises the construction of a business park and new transport hub facility, including ancillary uses, and infrastructure associated with; biodiversity, landscape, drainage, walking, cycling and other transport modes.

7.2.2 A full and more detailed description of the proposed development has been provided within Chapter 3 proposed development, whilst the aspects that are of particular relevance to this chapter and to the baseline environment at the site are described in subsequent paragraphs.

Baseline Environment

7.2.3 The proposed development overlaps with the boundaries of the Gwent Levels – Rumney and Peterstone Site of Special Scientific Interest (SSSI), designated for the network of reens rich in rare plant species and communities, and the Marshfield Site of Importance for Nature Conservation (SINC), designated for its damp semi-improved neutral grassland (see Figure 7.2).

7.2.4 The habitats within the proposed development boundary currently consist of predominantly arable and pastoral farming, with hedge and tree line field boundaries and reens throughout. There is recreational grassland and woodland in the west, and an area of wet woodland in the south adjacent to the railway line. The wider environment outside of the proposed development boundary comprises residential properties and Hendre Lake and Park to the west, St Mellons Business Park to the north, and with further agricultural land to the east and south.

7.2.5 Ecological surveys between 2017 and 2019 confirmed the presence / potential presence of a number of protected and / or notable species. This included foraging and commuting bats, dormice (*Muscardinus avellanarius*), otter (*Lutra lutra*),

[1] All plant and animal species, habitats and integrated plant and animal communities

water vole (*Arvicola amphibius*), European eel (*Anguilla anguilla*), foraging and commuting badger (*Meles meles*), breeding and wintering birds, barn owl (*Tyto alba*), grass snake (*Natrix helvetica*) and common lizard (*Zootoca vivipara*), and common amphibians (but not great created newts (*Triturus cristatus*)).

Biodiversity Strategy

7.2.6 The biodiversity strategy has been designed to retain as much habitat as possible and work towards a biodiversity net gain. This will be achieved through an integrated green and blue infrastructure which mitigates ecological loss and enhances overall biodiversity across the site. The biodiversity design also aims to replace and enhance habitat that is important to the previously identified protected and / or notable species. The principle areas within the biodiversity strategy are embedded into the design and are fully described in Section 7.10 and shown in Biodiversity Strategy Figure 7.4, and include:

- The 'Wildlife Corridor', running north west to south east, comprising a line of double hedgerows, enclosed by a swathe of wet woodland along one edge, and hazel-dominated woodland and a scrub / species-rich grassland mosaic along the other edge;
- A 12.5m wildlife buffer around Ty Ffynon reen, running north east to south west, comprising 1-2m verges of vegetation suitable for water vole foraging on the reen banks, alongside a hedgerow set back from the reen (to avoid shading), providing further connectivity across the site for dormice;
- A network of 4.2km of new species-rich intact hedgerows, planted strategically throughout the proposed development to maintain connectivity for dormice and foraging / commuting bats;
- Maintenance and enhancement of all Primary reens, and the introduction of 3.72km of new secondary reens and ditches to replace those secondary reens and ditches that will be lost;
- New woodland strip planting in the south, which when combined with the new woodland planting within the Wildlife Corridor, totals approximately 2.6ha (of 1.8ha dry woodland and 0.8ha wet woodland);
- 3.2 ha of new species-rich wet grassland planting and 8.9ha of new species-rich dry grassland planting;
- Mosaic of seasonally wet and dry grasslands and biodiverse native tree and hedgerow planting, including orchards, in the Main Park.

7.2.7 In addition to the soft landscaping listed above, opportunities for biodiversity protection and enhancement have been considered throughout the hard landscaping as well, including wildlife crossings and otter ledges in culverts, ecologically sensitive lighting designs, roadside wildflower planting, rain gardens and swales, living walls and micro-habitats.

7.2.8 Wildlife crossings, culverts and Sustainable Drainage Systems (SuDS) are embedded into the design of the Outline Planning Application (OPA) to Cardiff

Council and Planning Applications (PA) to Newport Council relating to the widening of Greenlane reen.

Drainage

7.2.9 SuDS will be implemented across the site to manage rainfall using methods that mimic natural process, by using landscape and vegetation to control the flow, volume and quality of the surface water runoff. In addition to this, SuDS also provide amenity benefits by providing aesthetically pleasing and natural landscapes, and biodiversity benefits by creating habitats for wildlife and vegetated areas. Full details are provided in the Drainage Strategy in Appendix C1 and the Hydrology and Flooding Chapter (Chapter 8).

Lighting Strategy

7.2.10 The principles for a lighting strategy for the proposed development has been considered with the relevant requirements for avoiding or reducing disturbance effects to protected species, with particular reference to artificial lighting guidance for bats[2]. For example, limited illumination is proposed in some public areas that intersect ecologically sensitive habitats, and where illumination is proposed it will be controlled to limit back spill, upward light, and glare onto surrounding vegetation. Lighting design principles are described within the chapter and the detailed lighting strategy will be designed at detail design stage and secured through the Reserved Matters Application (RMA) and planning conditions.

Construction Phasing

7.2.11 The construction of the proposed development will follow a phased approach (refer to Chapter 3 for full details of construction phasing), such that the majority of mitigation and enhancement planting (as outlined above) will begin within the initial phase (‘Phase 0’). This will allow new planting to better establish prior to any habitat removal required to facilitate the development. Translocation of valuable habitats is also proposed.

7.3 Legislation, policy context and guidance

7.3.1 A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. This is described in the following sections.

Legislation

Conservation of Habitats and Species Regulations 2017

7.3.2 The Conservation of Habitats and Species Regulations 2017 (the ‘Habitats Regulations’) transpose the requirements of Council Directive 92 / 43 / EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats

[2] Bat Conservation Trust and Institution of Lighting Professionals (2018) Guidance Note 8 Bats and Artificial Lighting

Directive) into law within England and Wales. These regulations provide for the designation and protection of sites of European importance know as European or Natura 2000 Sites. European Sites comprise:

- Special Areas of Conservation (SACs) designated under the Conservation of Habitats and Species Regulations 2017;
- Special Protection Areas (SPAs) designated under the Wildlife and Countryside Act 1981 (as amended) (WCA)[3];
- Ramsar sites designated under the Ramsar Convention 1971; and
- Candidate and proposed SACs and SPAs.

7.3.3 The Habitats Regulations require that consideration is given to the implications of plans and projects (developments) on European Sites. Specifically, Regulation 63(1) states:

a) "A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which -

i. is likely to have a significant effect on a European site or European marine site (either alone or in combination with other plans or projects), and

ii. is not directly connected with or necessary to the management of that site,

b) must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.".

7.3.4 The formal consideration of effects on European Sites is therefore undertaken by the determining authority, such as Welsh Government (also known as the Competent Authority).

7.3.5 The Habitats Regulations also convey special protection to a number of species which are listed in Schedule 2 of the Regulations and are referred to as European Protected Species (EPS). Those relevant to the proposed development include:

- All UK resident bat species;
- Common dormouse;
- Great crested newt (*Triturus cristatus*); and
- Otter.

7.3.6 Regulation 43 makes it an offence to:

- Deliberately capture, injure or kill any wild animal of a EPS;
- Deliberately disturb wild animals of such a species;
- Deliberately take or destroy the eggs of such a species;
- Damage or destroy a breeding site or resting place of such an animal.

7.3.7 Disturbance in the context of the offences above is disturbance which is likely to impair the ability of the animals to survive, to breed or reproduce, to nurture their

[3] The Wildlife and Countryside Act 1981 transposes the requirements of Directive 79 / 409 / EEC on the Conservation of Wild Birds (Birds Directive) in to UK law. The Birds Directive was updated through Directive 2009 / 147 / EC on the Conservation of Wild Birds.

young, to hibernate, to migrate; or to affect significantly the local distribution and abundance of the species.

7.3.8 Licences can be granted by Natural Resources Wales (NRW) for developments in Wales (sometimes referred to as EPS Licences or Derogation Licences) providing the purposes of the licence is for "*preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment*".

Ramsar Convention 1971

7.3.9 Wetlands of International Importance (Ramsar Sites) declared under the Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 are considered European Sites as a matter of Government Policy.

Wildlife and Countryside Act 1981 (as amended)

7.3.10 A network of nationally designated sites was established through the designation of SSSIs under the Wildlife and Countryside Act (WCA). The protection afforded by the Act means it is an offence to carry out or permit to be carried out any operation listed within the notification without the consent of the Statutory Nature Conservation Organisation (in Wales being NRW). The protection afforded to SSSIs is used to underpin the designation of areas at a European Level.

7.3.11 The WCA also places obligations on Welsh Ministers and other public bodies with regard to the conserving and enhancing of the features of SSSIs in the exercise of their functions.

7.3.12 The WCA provides protection to EPS and other species, including wild birds, water voles and reptiles.

7.3.13 All wild birds, their nests and eggs are protected, with some rare species afforded extra protection from disturbance during the breeding season (these species are listed in Schedule 1 of the Act). It is illegal to take any wild bird or damage or

destroy the nests and eggs of breeding birds. There are certain exceptions to this in respect of wildfowl, game birds and certain species that may cause damage.

7.3.14 Water vole receive protection under the WCA which prohibits the killing, injuring or taking by any method.

7.3.15 All native reptile species in the UK are subject to partial protection from intentional or reckless killing or injury only.

7.3.16 The Act also includes provisions for the control of Invasive Non-Native Species (INNS). Under these provisions it is an offence to:

- release or allow to escape into the wild any animal which is not ordinarily resident or a regular visitor to Great Britain, or is included in Schedule 9 of the Act;
- plant or otherwise cause to grow in the wild any plant which is included in Schedule 9 of the Act.

7.3.17 People undertaking works in proximity to INNS plants should take all reasonable steps and exercise all due diligence to avoid committing an offence.

The Invasive Alien Species (Enforcement and Permitting) Order 2019

7.3.18 The Invasive Alien Species (Enforcement and Permitting) Order 2019 came in to effect on 1st December 2019. This allows for the enforcement of the European Union (EU) Invasive Alien Species Regulation 1143/2014 on the prevention and management of invasive alien plant and animal species in England and Wales, including the relevant licenses, permits and rules for keeping invasive alien species.

7.3.19 This Order is similar to existing EU legislation, but there are a number of changes that apply to regulated species. If it is not a species of EU concern, then the Wildlife & Countryside Act (WAC; Section 14, Schedule 9) still applies.

7.3.20 Those working with in-scope plants need to be aware that the movement of live plants, or propagules, are covered by the Order – so, unless plants, or parts of

plants are being moved for the purpose of eradication, then a licence would be needed from NRW to carry this action out.

7.3.21 It is an offence under Part 2 Article 3 (2) to:

'*release or allow to escape into the wild any specimen which is of a species of animal which (a)is not ordinarily resident in and is not a regular visitor to Great Britain in a wild state, or (b) is included in Part 1 of Schedule 2'.*

7.3.22 It is also an offence under Part 2 Article 3 (3) to:

'*plant or otherwise cause to grow in the wild any specimen which is of a species of plant which is included in Part 2 of Schedule 2'.*

7.3.23 Part 1 of Schedule 4 of the Order also amends the Wildlife and Countryside Act 1981 (as amended) to remove the animals and plants listed on Part 1, Schedule 2 of the Order from Schedule 9 of the Wildlife and Countryside Act.

National Park and Access to the Countryside Act 1949 (as amended)

7.3.24 Local Nature Reserves (LNRs) can be given protection against damaging operations through powers within the National Parks and Access to the Countryside Act 1949. However, this protection is usually conveyed through inclusion of protection within local planning policy relating to these sites and other non-statutory sites such as Sites of Importance for Nature Conservation (SINCs).

The Protection of Badgers Act 1992

7.3.25 Badger and their setts are protected under the Protection of Badgers Act 1992 which makes it an offence to kill, injure or take a badger, or interfere with a sett.

Hedgerow Regulations 1997

7.3.26 The Hedgerow Regulations 1997 set out a framework for the protection of hedgerows against removal where they are deemed to be important either due to their age, ecological or archaeological features. Approval is required from the local authority prior to the removal of important hedgerows. Local authorities can enforce the retention of Important Hedgerows through the issuing of Retention Notices.

Salmon and Freshwater Fisheries Act 1975 (as amended)

7.3.27 The Salmon and Freshwater Fisheries Act (SAFFA) is legislation that aims to protect freshwater fish, with a particularly strong focus on salmon and trout. The legislation covers a broad range of topics, but of particular relevance to development are those sections covering water pollution, habitat disturbance and fish migration routes.

7.3.28 Under Section 2 (4) it is an offence to wilfully disturb spawn, spawning fish or spawning areas and under Section 4 (1) it is an offence to knowingly permit the

flow of poisonous matter and polluting effluents into river courses that are poisonous or injurious to fish or the spawning grounds, spawn or food of fish.

7.3.29 Sections 9 to 15 are concerned with fish passage and migration routes. It is the duty of the waterway owner that when constructing dams, screens or sluices to provide and maintain a facilitating fish pass for migrating salmon or trout. Section 9 allows the regulator to serve notice on the owner or occupier of a dam or obstruction, to install a fish pass where necessary. This section applies to dams which are either new or have been altered to create an increased obstacle to the passage of migratory salmonids. It is also applicable where dams in a state of disrepair have been rebuilt over at least one half of their length.

Eels (England and Wales) Regulations 2009

7.3.30 This implements Council Regulation (EC) No 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel. The regulations are focussed on the management of commercial eel fisheries (licences, catch returns and restocking) and the passage/migration of eels. The regulations afford powers to the regulators (Environment Agency and Natural Resources Wales) to implement eel recovery measures in all freshwater and estuarine waters in England and Wales.

7.3.31 Part 4 of the regulations is concerned with the passage of eels and makes it a legal requirement to notify the regulator of the construction, alteration or maintenance of any structure likely to affect the passage of eels. This include water intakes and outfalls, dams and weirs, sluices or any other in-river obstruction. Where any such structure exists, the owner, occupier or person in charge of the land on which the dam, structure or obstruction lies may be required to construct and operate an eel pass to allow the free passage of eels.

Natural Environment and Rural Communities (NERC) Act 2006

7.3.32 The Act is primarily intended to implement key aspects of the Government's Rural Strategy published in July 2004; it also addresses a wider range of issues relating broadly to the natural environment. The Act also makes provision in respect of biodiversity, pesticides harmful to wildlife and the protection of birds, and in respect of invasive non-native species. It alters enforcement powers in connection with wildlife protection and extends time limits for prosecuting certain wildlife offences. It addresses a small number of gaps and uncertainties which have been identified in relation to the law on sites of special scientific interest. It also amends the functions and constitution of National Park authorities, the functions of the Broads Authority and the law on rights of way (DEFRA website September 2016).

The Environment (Wales) Act 2016

7.3.33 The Environment (Wales) Act 2016 places a duty on public bodies in Wales to conserve and enhance biodiversity in the exercise of their functions. This duty includes consideration of the resilience of ecosystems in terms of their diversity,

connectivity, adaptability, scale and condition. The Act also reinforces duties in relation to the lists of species and habitats of importance and the duties to conserve and enhance those species and habitats. Within this chapter these are referred to as Section 7 Habitats and Species unless covered under other legal protections.

The Well-being of Future Generations (Wales) Act 2015

7.3.34 The Well-being of Future Generations Act requires public bodies in Wales to consider the long-term impacts of decisions on the social, cultural, environmental and economic well-being of both current and future generations.

7.3.35 In particular the Act includes a number of goals including to maintain and enhance a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change.

Wild Mammals (Protection) Act 1996

7.3.36 This Act operates in parallel with the legislation listed above conferring specific protection on rare or threatened mammal species by protecting all wild mammals from any action intended to cause unnecessary suffering.

Policy context and Local Biodiversity Action Planning

Planning Policy Wales (2018)

7.3.37 Planning Policy Wales[4] sets the national policies in relation to development control through the Town and Country Planning Act 1990. This is supported by a series of Technical Advice Notes, with Technical Advice Note (TAN) 5[5] being of particular relevance to this chapter as it sets out the consideration of nature conservation in the determination of planning applications.

Nature Recovery Action Plan 2015

7.3.38 Welsh Government has produced a Nature Recovery Plan which is aimed at addressing the underlying causes of biodiversity loss by putting nature at the heart of its decision-making, by increasing the resilience of Wales' natural systems (ecosystems), and by taking specific action for habitats and species. It sets out how Wales will deliver the commitments of the EU Biodiversity Strategy and the UN Convention on Biological Diversity to halt the decline in our biodiversity by 2020 and then reverse that decline. The plan builds on Wales' ground-breaking

[4] Welsh Government (2018) Planning Policy Wales
[5] Welsh Assembly Government (2009) Technical Advice Note 5: Nature Conservaton and Planning. Cardiff

new legislative framework The Well-being of Future Generations (Wales) Act 2015.

Cardiff Local Development Plan 2006 – 2026

7.3.39 The Cardiff Adopted Local Development Plan (LDP)[6] includes a number of policies, most relevant of which are policies EN5 (Designated Sites), EN6 (Ecological Networks and Features of Importance for Biodiversity), EN7 (Priority Habitats and Species), and EN8 (Trees, Woodlands and Hedgerows). These policies outline that developments will not be permitted where they cause harm to these features, unless the development fulfils certain criteria, such as the need for the development outweighing the nature conservation importance of the site, the developer demonstrating that there is no satisfactory alternative to the development, and effective mitigation and / or compensation measures are provided by the developer.

Newport Local Development Plan 2011- 2016

7.3.40 The Newport Adopted LDP[7] includes a number of key policies relevant to ecology and nature conservation, including SP5 (Countryside), SP9 (Conservation of Neutral, Historic and Built Environment), CE8 (Locally Designated Nature Conservation and Geological Sites) and CE9 (Coastal Zone). These policies outline that development will only be permitted if there is no overall loss of the nature conservation resource and that appropriate mitigation or compensatory measures can be achieved.

Cardiff Green 2017 Infrastructure SPG Ecology and Biodiversity Technical Guidance Note (TGN)

7.3.41 This Technical Guidance Note (TGN) forms part of the Green Infrastructure Supplementary Planning Guidance (SPG), which supplements policies in the adopted Cardiff Local Development Plan (LDP).

7.3.42 The LDP ecology, biodiversity and green infrastructure policies are intended to maintain and enhance biodiversity and green infrastructure, such that ecosystems are supported in their delivery of ecosystem services, in accordance with national and international strategies

The UK Post-2010 Biodiversity Framework

7.3.43 In 1992, the UK signed the Convention on Biological Diversity at the Rio Convention, pledging the UK to develop national strategies for the conservation and sustainable use of biological diversity. The UK Government subsequently produced ‘Biodiversity: The UK Action Plan’ (UKBAP) in 1994 which described

[6] Cardiff Council (2016) Cardiff Local Development Plan 2006 - 2026
[7] Newport Local Development Plan 2011-26. Adopted Plan January 2015. Newport City Council.

the biological resources of the UK as a whole and in turn led to the production of Biodiversity Action Plans for individual habitats and species.

7.3.44 Biodiversity policy within the UK was revised through the publication of the UK Post-2010 Biodiversity Framework[8] which succeeds the UKBAP covering the period from 2011 to 2020. A total of 65 Priority Habitats and 1,150 Priority Species were identified as the most in need of protection. Such species and habitats present in Wales were included in the list of Section 7 of the Environment Wales Act.

Wales Action Plan for Pollinators (2013)

7.3.45 The Action Plan for Pollinators in Wales[9] recognises that: *"Pollinators are an essential component of our environment. Honey bees 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."*

7.3.46 The Welsh Government has worked with industry and stakeholders to look in more detail at the evidence and issues around pollinators and their conservation in Wales. Following consultation, an 'Action Plan for Pollinators in Wales' was launched setting the strategic vision, outcomes and areas for action to halt and reverse pollinator decline in Wales. This plan aims to reduce and reverse the decline in wild and managed pollinator populations, which includes bees, some wasps, butterflies, moths and hoverflies, some beetles and flies. A pollinator task force comprising of key stakeholders is now active and a draft implementation plan is in place.

Cardiff Local Biodiversity Action Plan

7.3.47 The Cardiff Local Biodiversity Action Plan (LBAP)[10] was published in 2008 by Cardiff Council. It includes eight Habitat Action Plans and 12 Species Action Plans relating to the protection of biodiversity within the county. Of these Neutral Grassland, Reedbeds, Purple Moor Grass and Rush Pasture (Rhos Pasture), and Woodland Habitat Action Plans, as well as Bats, Dormouse, Great Crested Newt, Otter, Reptiles and Water Vole Species Actions Plans are considered likely to be applicable to the proposed development and surrounding area.

Newport Local Biodiversity Action Plan

7.3.48 The Newport LBAP[11] has a list of special habitats and species in the area and outlines how Newport City Council and partners plan to protect and enhance them. The priority habitats important for Newport include: Broadleaved, mixed

[8] JNCC and Defra (2012) UK Post-2010 Biodiversity Framework. Peterborough
[9] Welsh Government (2013) The Action Plan for Pollinators in Wales. Aberystwyth
[10] Cardiff Council (2008) Cardiff Local Biodiversity Action Plan 2008
[11] Newport Local Biodiversity Action Plan (Newport Biodiversity Partnership, 2014)

and yew woodland, Freshwater, Eetlands, Farmland, Lowland grassland and Heathland, Brownfield and Urban, and Marine and Coastal. The priority species important for Newport include: Bats, Otter, Water Vole, Fungi, Small Ranunculus and Shrill carder bee.

Environment Agency Severn River Basin District Eel Management Plan

7.3.49 The European Commission has initiated an Eel Recovery Plan (Council Regulation No 1100/2007) to try to return the European eel stock to more sustainable levels of adult abundance and glass eel recruitment. Each Member State is required to establish national Eel Management Plans (EMPs). Across England and Wales, the EMPs cover the UK's 15 River Basin Districts (RBD) defined under the Water Framework Directive. The aim of each EMP is to describe the nature of the eel population and fishery in the RBD, to assess whether the stock is meeting its 40% escapement target, and to present management actions that will ensure the long-term viability of the eel population biomass that would be produced under conditions with no anthropogenic disturbance due to fishing, water quality or barriers to migration.

7.3.50 The Severn RBD EMP[12] written by the Environment Agency lists a suite of actions which aim to contribute to the recovery of the stock of European eel. Many of these focus on improving access to habitat through removal/easement of existing barriers to migration, specifically on the Severn, Wye, Usk, Taff and Lwyd systems, and identifying target areas for habitat restoration. The EMP also commits to undertaking research into the potential for replacing tidal flap gates with structures that will allow eel passage into the drain systems in lower rivers and estuaries.

Relevant guidance

7.3.51 A range of guidance documents are available for biodiversity, but the principal assessment source used were the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the United Kingdom[13], which is described in more detail under Section 17.5 below. Guidance for specific species, groups and other ecological features is discussed in individual relevant sections and / or is provided in the

[12] Environment Agency (2010) Eel Management Plans for the United Kingdom; Severn River Basin District (2010). Available at: http://archive.defra.gov.uk/foodfarm/fisheries/documents/fisheries/emp/severn.pdf [Accessed 07.05.20]
[13] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Winchester

ecological baseline reports (Appendices E1 to E20). These guidelines are the current industry standard for ecological assessment.

7.4 Scoping and consultation

Scoping

7.4.1 During the scoping exercise, it was considered that the key ecological issues were likely to be the presence of the Gwent Levels – Rumney and Peterstone SSSI, the Marshfield SINC, and European Protected Species (EPS) (primarily dormice) in hedgerows and woodland within the proposed development boundary.

7.4.2 An Environmental Impact Assessment Scoping Report (issued to Cardiff Council on 5th July 2018) was submitted to statutory consultees and key interest groups in relation to the ES for the proposed development. Comments and Responses to the Scoping Report, relating to this chapter, are set out in **Table 7.1**. The Scoping Opinions are included in Appendix A1 of the ES.

Table 7.1: Response to scoping opinion

Consultee	Scoping opinion clause	Response
Natural Resources Wales (NRW)	*Significant construction phase traffic emission effects on the SSSI. Concerns about reliance on the cited significance criteria. Process contributions in relation to Critical Levels and Critical loads.*	The Air Pollution Information System[14] states that there is no comparable habitat with an established critical load estimate available for the Gwent Levels – Rumney and Peterstone SSSI, though the total nitrogen deposition is listed as 13.72 (max) 9.52 (min) 10.65 (avg) kg N/ha/yr. EPUK guidance[15] suggests that Nitrogen deposition should only be considered if the NOx concentration is increased over 0.4µg/m3 and the critical level is over 30 µg/m3. Air quality assessment results suggest that the ambient NOx concentration is not exceeded. As a result, it is considered not necessary to look at the critical load (Air Quality Chapter 8).
	Agree scope of species surveys in advance with CC Ecologist. *Habitat for and to allow dormice to use and move across the site.* *Robust buffers to the reen network* *Long term habitat management proposals* *Post-construction species and habitat monitoring* *Phasing proposals which demonstrate delivery of ecological mitigation and habitat creation early in the programme.*	Surveys scoped in for inclusion in response to consultation with CC and NRW. Landscape planting has been designed to replace lost dormouse habitat and enhance retained dormouse habitat and has been designed strategically to maintain connectivity throughout the proposed development. In operation, there will be 12.5m buffers between retained main reen banks and hard development. Where possible during construction, a 2m buffer should be provided between reen banks and construction activities or equipment in order to preserve the structural integrity of reen banks and to reduce the likelihood of construction run-off into reens. Habitat Management Plans for the maintenance and management of the various habitat types across the proposed development will be written during the detailed design stage; however General Management and Monitoring proposals are detailed in Section 7.14 of this chapter. The indicative phasing strategy (Chapter 3) details how most mitigation and enhancement planting will occur early in programme to allow new planting to establish prior to existing habitat removal.

[14] UK Centre for Ecology and Hydrology (CEH) (2016) Air Pollution Information System. http://www.apis.ac.uk/ [Accessed 25/03/2020]
[15] Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) (2017) Land-Use Planning & Development Control: Planning for Air Quality

Consultee	Scoping opinion clause	Response
	Loss of SSSI features within the development boundary during construction and operation. And loss/damage to SSSI features because of pollution and/or from any infrastructure needed to support the development even if "temporary". Indirect loss/damage to the features of the SSSI from poor quality surface water run-off, due to the interconnected nature of the drainage system impacts at this location could affect a large area of the SSSI; Reduction in the degree of access to ditch and reen edges with potential adverse impacts on their management and the SSSI features; Loss of grassland habitat and flora that supports shrill carder-bee (Bombus sylvarum) which is a qualifying feature of the Gwent Levels SSSI; Alterations to grazing levels and poaching levels within the SSSI Impacts on hydrology of the site.	Impacts to the SSSI are assessed within Section 17.11 of this chapter, with further detail given in the Hydrology and Flooding Chapter (Chapter 8). Grassland creation has been incorporated for the shrill carder-bee (see Section 7.10) and monitoring and management of grasslands and reens are described in Section 7.14.
	Location and operation of construction sites and works access.	Location and operation of construction sites and works access will be specified during detailed design.
Cardiff Council	*Implications of artificial light (to both nature conservation and amenity) to be addressed in more detail.*	The principles of the lighting strategy is described in Section 7.10 and has been written with consideration given to the ecology of the site, and with reference to artificial lighting guidance for bats[2]. At this stage the lighting strategy is only indicative, and will be finalised during the detailed design stage, in collaboration with ecologists.
	Any ES should include a section which considers the ecosystems present on the site, or of which the site is a part, and the predicted impact of the proposed scheme upon them.	The impact on Ecosystems are considered in Section 17.11 of this Chapter.
	Invertebrate surveys should include surveys for terrestrial species, specifically for S7 species: shrill carder-bee and brown-banded carder-bee (Bombus humilis).	Terrestrial invertebrate surveys were carried out in 2019 (Appendix E19).
	Semi-improved grassland habitats on site should be assessed to NVC level, and subsequently compared with regional SINC selection criteria to allow their value to be considered in the context of Section 5.3.11 of PPW 2016 and Section 5.5.3 of TAN5.	All semi-improved grassland sites were subject to NVC survey in 2018 and 2019 and assessed against regional SINC criteria (Appendix E4 and Appendix E5, respectively).
	Any ecological mitigation proposed at this site, for example for protected species or SSSI features, should be set out in the context of a green infrastructure approach, whereby ecology, trees landscaping and soils, access, recreation, public open space and SuDS are considered holistically, to secure maximum benefits for the eventual users of this site.	All ecological mitigation has been designed in collaboration with other disciplines to ensure holistic approach.
	Unclear as to whether surveys include impact on ground nesting birds.	Transects walked during the breeding and wintering birds survey reports (Appendix E17 and Appendix E18, respectively) aimed to also record ground nesting birds.
	Climate Change adaptation measures should be included within the design.	Climate Change adaptation measures are detailed within the Climate Change Chapter (Chapter 14).
	Compliance with Habitat survey measures set out within Green Infrastructure SPG.	Baseline survey methodology is described within Section 17.5 of this Chapter.
	Impacts on SSSI should be informed by new guidance (plans to revise CCW 1991 document in relation to the Gwent Levels).	Impacts on SSSI are assessed using 1991 guidance[16], due to no update being issued.
	Fragmentation, arising from vehicular access to the main development site across Faendre Reen and Cypress Drive to be addressed.	Impacts associated with fragmentation are addressed in Section 17.11 of this chapter.

[16] CCW (1991) Nature Conservation and Physical Developments on the Gwent Levels - The current and future implications. Chapter 6: Conservation Guidelines for Development Proposals on the Gwent Levels

Consultee	Scoping opinion clause	Response
	Comment that there is a lack of consideration of the potential impact on soil as a resource and the fact that soil functionality may be impaired. *Hedgerows on site likely to qualify as important and therefore efforts should be made to preserve them.*	Soil Resource Survey and Plan (as part of the Ground conditions Chapter 6) has been undertaken in accordance within 2009 Defra code[17]. Impacts to hedgerows are assessed and mitigation proposed within , Section 17.9, 17.10, 17.11 and 17.12 of this chapter. Hedgerows are also assessed for historic quality, as detailed in Heritage Chapter 10, Section 10.10.12.
	Compliance with Policy KP15 – Climate Change. *HRA needed due to proximity to Severn Estuary.* *Mitigation and compensation measures related to impact on the SINC.* *Nesting or roosting opportunities for birds and bats should be incorporated into new build.* *Use of green roofs and walls should be considered.* *Wedge of green space between Faendre Reen and Cypress drive is likely to support significant nature conservation interest – every effort should be made to minimise impact on this area.*	Climate Change adaptation measures are detailed within the Climate Change Chapter (Chapter 14). A Habitat Regulations Assessment (HRA) will be submitted with the Planning Application. Mitigation and compensation measures related to impacts on SINC are included within Section 17.9, 17.10, 17.11, and 17.12 of this chapter. These include translocation of turfs and soils from the SINC in to the grassland mitigation areas in the south of the proposed development. Bird boxes, barn owl boxes and bat boxes will be included within the proposed development, as outlined in Section 17.10 of this chapter. Green roofs and facades will be incorporated where appropriate within the proposed development (as detailed in the Design and Access Statement (DAS)) but will form part of the detail design and Reserved Matters Application. This woodland and grassland area is being crossed in two locations for access into the proposed development. Impacts on this area are assessed within Section 17.11 of this chapter.
Newport City Council	*Potential for indirect impact on adjacent fields – disturbance should be considered.*	Disturbance impacts have been assessed within this chapter under Section 17.11.

Consultation

7.4.3 Consultation was carried out with NRW and Cardiff Council, beyond the scoping responses. Table 7.2 below summarises the meetings and consultation in relation to biodiversity.

Table 7.2: Response to representations from stakeholders on scope of Biodiversity assessment

Stake holder	Date	Format	Comment	Response
Cardiff Council	19/09/19	Meeting - Discuss Ecology Approach with Cardiff Council (CC)	• CC - confirmed that the northern and southern areas of the site should be treated as being mutually exclusive for the purposes of calculating replacement habitat ratios, i.e provide greater than 2:1 ratio replacement in the south to compensate for the less than 2:1 in the north. • Quality of habitat was agreed to be part of any strategy and could potentially be a means to facilitate lower ratios.	• Arup calculated habitat loss and mitigation for the whole of the site, ensuring that mitigation exists in both the south and north of the railway line. Considering as mutually exclusive is inaccurate for biodiversity calculations / net gain when mobile ecological features can move between areas and the planning application is considered one area. Habitats have been mitigated by at least 1:1 and in most cases the habitat created will be of higher species diversity and provided enhancement habitats for protected species when established, see Section 7.10. • Arup used habitat quality such as hedgerow classification under the phase 1 classification (intact species rich, defunct species poor etc), and reen quality (wet or dry, vegetation etc) to inform

[17] Defra (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites

			• CC stressed the need for connective corridors. • The shrill carder-bee (Section 7 species) to be given specific consideration in the application. • CC would not object to relocating the SINC to the south. • The width of the railway line is significant, and CC did not believe a "mouse tunnel" would be workable given the length. • Application should include highway lighting as a key area for consideration where it would impact on ecological spaces.	mitigation strategy, see Section 7.10 below for more details. • Arup designed connective corridors through the site to ensure connections with surrounding habitats, see Biodiversity Strategy Figure 7.4. • Arup have considered existing shrill carder-bee habitat and habitats will be created as part of the biodiversity strategy specifically designed and manged for shrill carder-bee , including the mosaic habitat creation they require, see Section 7.10 below for more details. • Arup have included translocation of SINC habitat (turfs) and soils, see Section 7.10 below for more details. • Arup engaged with Arup dormouse specialist working on large infrastructure projects and other dormouse specialist across UK, including the People Trust for Endangered Species (PTES) for advice on dormouse bridges and provide evidence-based design. Lengths of plus 30m, and up to 70m, have evidence of use in relation to motorways and dormouse crossings. Nevertheless, a dormouse bridge cannot be included over the electrified railway line due to Network Rail health and safety requirements. • Arup's principles for the lighting strategy has been designed around best practise sensitivity to ecological features, see Section 7.10 below for more details.
Cardiff Council	30/01/20	Meeting – Discuss Green Infrastructure and Ecology Approach with Cardiff Council	• CC agreed in principle with the wildlife corridor and connective corridors, alongside mitigation proposed in the south, to be sufficient for the replacement of habitats, but would like to review the ecological assessment. • CC agreed in principle that the dormouse strategy could include translocating individuals into the council land at Hendre Lake, however population analysis is required. CC also confirmed that dormouse presence was unknown until relatively recently and then through recent planning applications, their population has been shown to be relatively high in the Gwent Levels. • CC agreed to an on-site meeting with the Park team to assess areas suitable for woodland creation and enhancement. • CC commented that woodland planting would align with CC Policy of Increasing Canopy Cover. • CC queried the management plan for the created species-	• Arup organised an on site meeting with Arup's ecological and landscape team and CC ecologist and CC Parks representatives. However, the draft assessment was not sent to CC. • Arup conducted further population analysis and due to the population being high, or even at capacity, within the site and likely within the Council land at Hendre Lake, the decision was taken to advise translocation of dormouse out of the site to a receptor site not adjacent to the site. See Section 7.9 for further details. • Arup organised an on-site meeting with Arup's ecological and landscape team and CC ecologist and CC Parks representatives, see meeting notes (19/03/20) below. • The Biodiversity Strategy (Figure 7.4) delivers 0.8ha of wet woodland (ratio 1:1.62 or 63% increase), and 1.8ha of woodland (hazel dominate) (ratio 1:1.95 or 15% increase). Section 7.10 for the full description of habitats to be created. • General Management and Monitoring proposals are detailed in Section 7.14 of this chapter.

			rich grassland within the planning boundary. • CC suggest mink control is considered for the site after mink found to be present and water vole numbers to be reduced in 2019 surveys. • CC inquired about habitat connectivity under the bridges crossing the reens.	• Arup have proposed a Mink Control programme, to be determine in consultation with NRW, see Section 7.12 below for more details. • Dormouse bridges are embedded into the design where the roads cross Feandre Reen, as detailed in Section 7.10. Habitat enhancements have also been included to encourage winder connectivity for dormouse with the wider habitat networks.
Cardiff Council	19/03/20	On-site meeting to discuss mitigation and possible enhancements with Hendre Lake park.	• CC confirmed that translocation should be considered if dormouse population is at capacity or near capacity, especially as the area lacks hazel. Dormice are likely surviving on insects, flowers and berries from hawthorn and blackthorn which is more dominant within the area. • CC to look at any potential sites which would be suitable under the Dormouse Handbooks guidelines in the Cardiff Region. • CC agreed that the search for a receptor site would have to be widened if none were available. • CC showed recent tree planting within the site and confirmed that there are limited areas for more planting due to the conflict between the carder-bees found on site and need to open space and views from adjacent housing.	• The dormouse strategy has included translocation of dormice from the site to ensure the favourable conservation status of the species is maintained. Dormouse were found in high population density, likely to be at carrying capacity due to the number of dead dormice found (likely to have died from starvation). See Section 7.9 for more details. • At the time of writing CC had not provided any potential local translocation sites and consultation with NRW regarding dormice was on-going. • At the time of writing on-going consultation with NRW and PTES regarding dormouse translocation. • Apart from planting around the road crossing through the council land to ensure and encourage safe crossing by dormice over the dormice bridges, no further woodland planting is proposed within the council land.
NRW – South Area Meeting	24/07/19	Meeting	• NRW queried ditch loss and lack of connectivity between retained reens. NRW "disappointed more reens are not retained to north". • NRW concerned about the viability of new reens and possible impacts on existing reens. • Suggested additional enhancement measures for reens in the south, relating to 'reen grips' comprising traditional agricultural irrigation channels	• The Biodiversity Strategy (Figure 7.4) and the Drainage Strategy (see Hydrology and flooding Chapter 5) provides additional 4.5 km of reens introduced to the south of the railway line to mitigate loss of reens to the north of the railway line on a 1:1 basis. • Arup reviewed the drainage consequences in conjunction with civil engineering team and modelled the effects, details provided in the Hydrology and flooding Chapter 5. • Grips and the historical undulations of the levels field patterns have been designed into the FCA and species rich grassland area south of the railway line, see Section 7.10 for details.
NRW	30/10/19	Meeting – Species	• NRW noted that it is important to contextualise the mitigation strategy to demonstrate connectivity	• The Biodiversity Strategy (Figure 7.4) maintains and provides both green and blue infrastructure and connectivity within the site and to the wider existing network. See Section 7.10 for details.

			within the site and wider network (if appropriate) • NRW reaffirmed licensing criteria under the habitat regulations i.e. no satisfactory alternatives, overriding public interest and ensuring favourable conservation status of protected species • NRW noted that a lighting strategy is critical along the main access road and other significantly lit areas of the proposed development, to ensure compatibility with ecology. • NRW raised issue of Water Voles. Ask that Arup give this species the same scrutiny as dormouse. Arguably, less disruption to their habitat but buffer zones and the relationship with urban fringe will be important to evidence through detailed sections • NRW suggested two standalone conservation strategies are included in EIA for water voles and dormouse. • NRW noted that avoiding reen shading is important. Need to demonstrate the quality of environment for the primary reens alongside / in between built up areas. • NRW noted have accepted a habitat ratio of 2:1 on infrastructure projects • NRW ask for details of long term management strategy covering a range of events to provide comfort that proposals are deliverable. Includes management plan for long term future of the habitats, demonstrate how these will be managed and safeguarded – legal agreements, maintenance and how it will be taken forward. Section 106.	• The dormouse strategy has included translocation of dormouse from the site to ensure a favourable condition of the species. Dormouse were found in high population density, likely to be at carrying capacity due to the number of dead dormouse found (likely to have died from starvation). See Section 7.9 for more details. • The principles of the lighting strategy is described in Section 7.10 and has been written with consideration given to the ecology of the site, and with reference to artificial lighting guidance for bats[2]. At this stage the lighting strategy is only indicative, and will be finalised during the detailed design stage, in collaboration with ecologists. • Water voles have been fully considered within the Biodiversity Chapter and a displacement strategy is proposed, see Section 7.10 for details. • The dormouse and water vole strategies, alongside likely licence requirements, are described in Section 7.10. • In operation, there will be 12.5m buffers between retained main reen banks and hard development, see Section 7.10 for further details. • The assessment of habitats loss vs gain has been calculated on both quantity and quality; while achieving over 1:1 in all cases, the quality in term of species diversity and functionability however provides an overall biodiversity gain. See Section 7.10 for the full description of habitats to be created. • General Management and Monitoring proposals are detailed in Section 7.14 of this chapter.
CADW / Parc Nantgarw Business Park	06/01/20	Meeting - Initial engagement	• The major concerns from a historic landscape perspective are the reens, ditches and grips[18]. CADW understood that retention of the main	• Grips and the historical undulations of the levels field patterns have been designed into the Flood Compensation Area (FCA) and species rich

[18] A complex system of channels that work almost entirely under gravity carry surface water off fields through structures known as field 'grips' (shallow surface ditches in the field), into field-ditches and then into the interconnected 'reens' that surround each field and main rivers. This water is then released at intervals into the Severn estuary at tidal creeks known as 'pills' through tidal flaps known as 'gouts'.

			reens was "probably the best that could be achieved".	grassland area south of the railway line, see Section 7.10 for details.
Cardiff Rivers Group	06/01/20	Meeting - Initial engagement	• Biggest concern is litter which "comes with development". He suggested appropriate bin design as a mitigation measure (closing bins).	• As this is an outline planning application, details such as bin design, location and availability are not considered. This would be a matter for later in the project development and following discussion with Cardiff Council regarding waste management options. This will form part of the reserved matters submission and will also probably form part of the S106 on waste management contribution in line with the Cardiff Waste Collection and Storage Facilities SPG.
Living Levels	06/01/20	Meeting - Initial engagement	• The Orchard project is looking to plant apple and pear trees within the levels, an area where orchards used to be common. Bishop Chards School in St Mellons is the first in the levels to have an orchard. • Living Levels identified Mink as an intrusive species in the levels. Living Levels queried what mink protection measures were to be included in the development. • Installing Grips would be ideal and would fit with the aspirations of the Living Levels	• Orchard planting has been incorporated into the indicative planting proposed within the Main Park, as described in the DAS. • Arup have proposed a Mink Control programme, to be determine in consultation with NRW, see Section 7.12 below for more details. • Grips and the historical undulations of the levels field patterns have been designed into the FCA and species rich grassland area south of the railway line, see Section 7.10 for details.

7.5 Methodology

Overview

7.5.1 The following sections set out the methodology used to establish baseline conditions and assess the effects of the proposed development both in terms of construction and operational effects.

7.5.2 The baseline ecological information for the proposed development was collated through a combination of a desk study, habitat and botanical surveys, and species-specific surveys. The methodology for establishing baseline conditions is set out in the following sections.

7.5.3 Survey work was undertaken by a number of suitably qualified professional ecologists employed by Arup along with employees of various sub-consultancies. Surveyors were assessed as being competent in terms of their knowledge and experience to lead surveys for that particular species or habitat group. Sub-consultants used are set out in the methodology sections below.

7.5.4 The survey findings represent those at the time of survey and reporting, and data collected from available sources. Ecological surveys are limited by factors which

affect the presence of plants and animals, such as the time of year, migration patterns and behaviour.

Methodology for establishing baseline conditions

Study Area

7.5.5 The ecology of the proposed development and surrounding area was surveyed primarily over three years (2017-2019). Due to the evolution of the proposed development over the years, as well as specific survey method requirements for different ecological features and species, the survey areas for each survey type vary in shape and size.

7.5.6 The ecological surveys were carried out within the proposed site boundary and adjacent areas where required, these are individually described and displayed within the relevant baseline survey reports and associated figures in Appendices E1 to E20, which are:

- Appendix E1: 2017 Extended Phase 1 Habitat Survey Report;
- Appendix E2: 2019 Extended Phase 1 Habitat Update Survey Report;
- Appendix E 3: 2017 Schedule 9 Plant Survey Report;
- Appendix E4: 2018 Vegetation Survey Report;
- Appendix E5: 2019 Vegetation Survey Report;
- Appendix E6: 2018 Arboricultural Survey Report;
- Appendix E7: 2017-2018 Bat Survey Report;
- Appendix E8: 2019 Bat Survey Report;
- Appendix E9: 2017 Dormouse Survey Report;
- Appendix E10: 2018 Dormouse Survey Report (Cypress Drive);
- Appendix E11: 2019 Dormouse Survey Report;
- Appendix E12: 2017 Riparian Mammal Survey Report;
- Appendix E13: 2019 Riparian Mammal Survey Report;
- Appendix E14: 2017 Amphibian and Reptile Survey Report;
- Appendix E15: 2019 Great Crested Newt Survey Report;
- Appendix E16: 2017 Badger Survey Report;
- Appendix E17: 2017 Breeding Birds Survey Report;
- Appendix E18: 2017-18 Wintering Birds Survey Report;
- Appendix E19: 2019 Terrestrial Invertebrates Survey Report; and
- Appendix E20: 2018 Invertebrates Survey Report.

7.5.7 For the purposes of this chapter, all the results obtained during these surveys are described, including those that lie outside of the current planning boundary. The planning boundary is shown on Figure 1.1.

Desk Study

7.5.8 In 2017, records of protected and / or notable species, Schedule 9 INNS and non-statutory sites within 2km of the proposed development centre point were obtained

from the South East Wales Biodiversity Records Centre (SEWBReC)[19]. The search was extended to 5km for records of bats.

7.5.9 A desk study was carried out in 2019 to identify statutory designated European Sites and national sites within 10km and 2km of the Planning boundary, respectively. The search was extended to 30km for SACs designated for the presence of bats. Online searches were carried out using the Multi Agency Geographic Information for the Countryside (MAGIC)[20], and the Joint Nature Conservation Committee (JNCC)[21] website.

7.5.10 These records are summarised under the baseline environment sections within 7.7 below.

Field Surveys

7.5.11 A summary of the methodologies for all baseline field surveys conducted in 2017 to 2019 are described in the subsequent sections. Further detail of both the methodology (including weather conditions during surveys) and results of these surveys can be found in the baseline survey reports in Appendices E1 to E20.

7.5.12 Where the 2019 survey was a repeat survey from those previously undertaken in 2017 and / or 2018 the survey methodology has not been repeated. If the survey methods differed between years an explanation of the differences are provided, and where no repeat survey was undertaken in 2019, an explanation as to why an update survey was not repeated is provided.

Extended Phase 1 Habitat Survey

7.5.13 An Extended Phase 1 Habitat survey was carried out in January 2017 outwith the optimal survey season for habitats (see Appendix E1). This was then updated through a ground-truthing and extended study area Phase 1 habitat survey, within the optimal survey season, in July and August 2019 (see Appendix E2).

7.5.14 The 2019 survey was carried out by Arup and Levan Ecology Ltd. ecologists, in accordance with standard JNCC Phase 1 habitat survey methodology[22]. Habitat areas greater than 0.1 hectares were mapped and Target Notes (TNs) were used to highlight any features / habitats of interest.

7.5.15 The survey area in both 2017 and 2019 were searched for evidence of INNS plants listed under Schedule 9 of the WCA, such as Japanese knotweed (*Fallopia japonica*), Indian balsam (*Impatiens glandulifera*) and giant hogweed (*Heracleum mantegazzianum*).

7.5.16 In conjunction with the habitat survey, the potential for the survey area to support any legally protected species and / or other species of nature conservation

[19] Data received on the 31st January 2017
[20] Defra MAGIC https://magic.defra.gov.uk/MagicMap.aspx [Accessed 19/12/2019]
[21] JNCC http://jncc.defra.gov.uk/ [Accessed 19/12/2019]
[22] JNCC (2010) Handbook for Phase 1 habitat survey – a technique for environmental audit

importance was recorded. Relevant species included all those protected by European or UK law, and notable species including Section 7 species.

7.5.17 Further details on the methodology and any limitations of these surveys can be found in the 2017 and 2019 Extended Phase 1 Habitat Survey reports, in Appendices E1 and E2, respectively.

Schedule 9 INNS Survey

7.5.18 In addition to the search for INNS carried out during the 2017 Extended Phase 1 Habitat survey, the survey area (Figure 2 in Appendix E1) was surveyed specifically for INNS plants over the course of three days in August and September 2017, within the optimal survey period for INNS. The survey area was walked over and the species present and the extent of each plant was recorded. Further details on the methodologies used are provided in Appendix E3.

7.5.19 In July and August 2019, the presence of INNS within the survey area was recorded during the 2019 Extended Phase 1 Habitat survey and the methodologies are further described in the baseline report (Appendix E2).

National Vegetation Classification (NVC) Survey

7.5.20 On the basis of the 2017 Extended Phase 1 Survey results, five areas of grassland were selected for a Phase 2 vegetation survey. These areas (Figure 1 in Appendix E4) were subject to surveys in accordance with best practice National Vegetation Classification (NVC) methodology[23]. Surveys were undertaken during the week commencing 24th September 2018 by Sturgess Ecology Ltd.

7.5.21 The vegetation communities were initially assessed by eye during a walkover, with the identified communities subsequently sampled by means of 2x2m quadrats. Plants were identified to species, and their percentage cover within the quadrat recorded. The analysis of the quadrat data was undertaken using the surveyor's experience, rather than the use of any analytical software. See Appendix E4 for further methodology details.

7.5.22 Due to the timing of the 2018 NVC survey (i.e. late September), some species may have been overlooked or undetectable. As such, a supplementary survey was undertaken of the grasslands within the Marshfield SINC and adjacent fields on the 18th July 2019, again by Sturgess Ecology Ltd .

7.5.23 The 2019 survey comprised walking a series of transects through the SINC and adjacent fields to try and identify plants that were not recorded during the 2018 survey (in particular, the locally uncommon plants pepper saxifrage (*Silaum*

[23] Rodwell et al. (1991-2000) British Plant Communities. Volumes 1-5. Cambridge University Press. Cambridge

silaus) and stone parsley (*Sison amomum*) that have been previously recorded in the Marshfield SINC). See Appendix E5 for further methodology details.

Reen Flora Survey

7.5.24 A survey of the reen vegetation present within the survey area was undertaken in conjunction with the 2018 NVC survey by Sturgess Ecology Ltd. The survey methodology was adapted from guidance for reen flora monitoring[24].

7.5.25 The survey was based on detailed examination of several 20m lengths of reen (Figure 2 in Appendix E4). The relative frequency of floral species on the bank and in the water were estimated separately using the DAFOR scale (Dominant / Abundant / Frequent / Occasional / Rare). Aquatic plants were sampled using a hooked stick and grapnel, with sampling undertaken throughout the whole length of each 20m section. Most plants were identified in the field, but specimens of certain groups were collected for subsequent identification by microscope.

7.5.26 In addition to the 20m sampling sections, observations were made along the adjacent bank to give approximately 100m sections. This was limited to a walk-over along the bank and did not include grapnel sampling. See Appendix E4 for further methodology details.

7.5.27 As with the NVC survey, a follow-up reen flora survey was undertaken on the 2nd August 2019 to identify species that may have been overlooked or undetectable during the 2018 survey. The 2019 survey comprised walking along the banks of the 2018 survey sections, with grapnel sampling carried out on an occasional spot-check basis through the entire 100-150m section length. See Appendix E5 for further methodology details.

Hedgerows

7.5.28 All hedgerows within the survey area were surveyed during the Extended Phase 1 Habitat Surveys in 2017 and 2019 (Appendices E1 and E2), and classified under the Phase 1 Habitat codes depending on number of species present (species-rich or species-poor), functionality (intact or defunct), and if trees are present[25]. The majority of the hedgerows within the planning boundary were identified as species-poor during the Extended Phase 1 Habitat surveys (see Figure 7.3). As such, no specific surveys have been undertaken to assess the hedgerows in relation to the hedgerow species criteria within the Hedgerow Regulations 1997 (being at least seven woody species within 30m section of hedgerow to classify as 'Important hedgerow'). Although the Hedgerow Regulations 1997 have been

[24] CCW (1996) Flora monitoring on the Gwent Levels Sites of Special Scientific Interest. Cardiff
[25] JNCC (2010) Handbook for Phase 1 habitat survey – a technique for environmental audit

considered within the assessment, due to the presence of EPS species within the hedgerows, see baseline conditions below.

Bat Surveys

Roosts

7.5.29 A Ground Level Tree Assessment (GLTA) and tree climbing inspection was undertaken on 142 trees and 86 groups of trees (as identified by tree plans within the Arboricultural Survey Report (Appendix E6)) within the survey area in July and August 2018 (Appendix E7). This was conducted by two licensed bat ecologists and certified tree climbers (from Arup and Johns Associates), in line with Good Practice Guidelines[26].

7.5.30 Following the GLTA, trees with bat roosting features above 'negligible' were subsequently climbed and inspected as far as possible to confirm / review their bat roosting potential, as described in Table 7.3 below.

Table 7.3: Categorisation of the potential for bat roosts within trees and buildings

Suitability	Description Roosting Habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and / or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation. A tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen with only very limited roosting potential.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protected, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).
High	A structure or tree with one or more potential roost sites that are obviously more suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of line due to their size, shelter, protection, conditions and surrounding habitat.

7.5.31 Equipment used included binoculars and a powerful torch, and where possible, a ladder and endoscope. Trees subject to tree climbing inspections to further examine Potential Roosting Features (PRFs) were conducting using an endoscope. The locations of trees subject to a GLTA and tree climbing assessment are shown on Figure 4 of Appendix E7.

7.5.32 Buildings were also categorised as having negligible, low, moderate or high suitability for bats depending on the construction of the building and the presence of potential bat access points ascertained by external inspections if necessary, using close focusing binoculars / monoculars (see Figure 4 of Appendix E7).

7.5.33 The same trees/tree groups were then subject to an update GLTA survey and subsequent tree climbing survey in 2019, by licenced and suitably qualified ecologists from Just Mammals Ltd (Appendix E8). Visual assessments of trees

[26] Collins, J (2016) Bat Surveys: Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd ed). The Bat Conservation Trust. London

were undertaken from the ground in line with bat roosts in trees guidance[27], with the aim being to assess any PRFs, such as trunk cavities / hollows and lifted bark, against a six-point 'risk scale'[28] to establish the Bat Roosting Potential (BRP) of a tree. Details of the risk scale are given in Table 7.4.

Table 7.4: Bat roost risk scale of trees

Risk Scale	Level of Risk	Reasons for Assessed Risk
1	None	No features which bats could use
2	Minimal	Some light ivy growth or shallow cavities, bark damage
3	Minor risk	Loose bark, moderate ivy growth, some small broken branches
4	Potential roost	Deep slot crevices, trunk or limb / branch cavities, dense ivy growth
5	Probable roost	Deep slot crevices, trunk or limb / branch cavities with staining
6	Bat roost	Actual bat or evidence or bat presence (e.g. bat droppings)

7.5.34 Trees that were assessed as a 'Level 4' or above were also subject to additional assessment with a minimum of two dusk emergence observation (with the number of visits dependant on the BRP). Where three dusk emergence observations were undertaken these were conducted with a survey visit in each June, July and August 2019 (where only two surveys were undertaken these were in July and August 2019). Surveys commenced 30 minutes before sunset and continued for at least one hour after sunset. A single surveyor was positioned for each tree at ground level in a location which gave optimum views of the PRF(s) offering BRP. Surveyors were equipped with a Pettersson D-240X bat detector and a Roland RO-5 to hear and record any bat echolocation calls throughout the survey. Calls were analysed after the survey using BatSound sound analysis software to confirm the species recorded during the survey. See Appendix E8 for further methodology details.

Bat Activity Transects

7.5.35 Walked transect surveys were undertaken on four routes to record bat activity and behaviour within the survey area in 2017, as shown on Figure 2 in Appendix E7, in line with guidance[26]. These were conducted by Wildwood Ecology Ltd.

7.5.36 The transect routes were walked once a month between May and October 2017, alternating the direction the transects were walked each month to balance any temporal variation in behaviour levels. All surveys were carried out at dusk, commencing at sunset and ending two hours after sunset. The surveys were conducted using an Elekon Batlogger M, which enabled each bat echolocation call to be linked to a specific location, through Global Positioning System (GPS) and

[27] Andrews, H (2018) Bat Roosts in Trees. Pelagic Publishing. Exeter
[28] Developed and copyrighted by the Just Mammals Consultancy LLP (Appendix E8)

time recorded. Further detailed survey methodologies as well as limitation and assumptions are provided in Appendix E7.

7.5.37 The habitats represented along the transects, as well as timings and weather conditions for all surveys are describes in Appendix E7.

7.5.38 These transect surveys were then updated in 2019, by a combination of suitably qualified ecologists from Arup and Just Mammals Ltd (Appendix E8). Five transect routes were walked once a month between May and October 2019. These transects were based on the four routes surveyed in 2017 and additional targeted areas of potential foraging and commuting habitat, as shown on Figures 3 to 7 in Appendix E8.

7.5.39 The transects commenced at sunset and walked in a different direction each month. When bats were encountered along the transect, the time and grid reference location were recorded, along with brief details of the bat activity including the number of bats, flight direction, fight height, commuting, and foraging.

7.5.40 Surveyors were equipped with a Pettersson D-240X bat detector and a Roland RO-5 to hear and record any bat echolocation calls throughout the survey, and a Satmap Active 10 hand-held GPS device to record grid reference details of observations during the survey. Calls were analysed after the survey using BatSound sound analysis software to confirm the species recorded.

Static Bat Activity Monitoring

7.5.41 Static bat detectors were used to record bat activity over a five-night period each month from May to October 2017, in accordance with best practice guidance[26]. Eight locations were selected within the survey area, as shown on Figure 3 of Appendix E7, to provide a representative sample of the different habitats present within the survey area with the aim of identifying the relative importance of these.

7.5.42 Static monitoring was undertaken using Wildlife Acoustic Song Meter 2 Ultrasonic Bat Detectors (SM2+ BAT) with SMX-U1 microphones. Detectors were set to record between 18:00 and 07:00 each night.

7.5.43 The microphones used with the detectors during the course of the surveys were regularly checked and calibrated to ensure that they were functioning properly. Microphones that did not show a significant response to the output of the calibration unit were replaced.

7.5.44 The files from the Wildlife Acoustics detectors were downloaded and processed using Kaleidoscope Pro Software. The processing also included the automatic identification of bat species based on the classifiers developed by Wildlife Acoustics (Bats of Europe 4.3.0). The files produced by the processing were then reviewed to ensure correct identification of species and to identify where possible

the bat species for any calls that could not be recognised by the software. Bat file analysis is further detailed in Appendix E7.

7.5.45 The number of files (sound clips) recorded by the detectors each night was taken as a proxy value to the number of bat passes. This was then used to calculate a Bat Activity Index (BAI) for each species at each location during each session. The BAI was calculated on the first five nights recorded each month. Any additional night's recordings where rarer or more notable species were recorded, their presence was included in the analysis to ensure their representation within the data in terms of species diversity.

7.5.46 The average BAIs for all species (sum of individual BAIs) at each location has been calculated over the active months from May to October 2017.

7.5.47 The time of recording of the first bat of each species, each night, and time of last recording were also compared to sunset and sunrise times obtained using Anasun software to infer the potential proximity of roost sites.

7.5.48 Further detailed survey methodologies as well as limitation and assumptions for all bat surveys are provided in Appendix E7 and E8.

7.5.49 The transects were repeated to provide up to date information on flight routes used by bats to indicate the potential presence of a roost within the proposed development or immediate vicinity. Passive static monitoring surveys were not repeated as the broad habitats within the site had not changed significantly from the previous surveys in 2017 and therefore activity levels were not expected to have changed significantly.

Dormouse Survey

7.5.50 To confirm the presence or likely absence of dormice within the survey area, a nest tube survey was undertaken in accordance with best practice guidance[29] in 2017 by Wildwood Ecology Ltd (Appendix E9). An additional area was then surveyed along Cypress Drive by Arup ecologists in 2018 (Appendix E10). Both of these initial surveys were then updated by Arup ecologists in 2019 / 2020 (Appendix E11).

7.5.51 A total of 127 nest tubes were placed within suitable habitat in May 2017, at locations shown in Figure 2 in Appendix E9. Nest tubes were spaced between 15m and 20m apart, with entrance holes facing the centre of vegetation. Tubes were numbered, and the location recorded by GPS to allow for repeatability of surveys and the positive location of any survey findings. Nest tubes were inspected monthly (every four weeks where possible) between the 24th May and

[29] Bright, P; Morris, P; Mitchell-Jones, T (2006) The dormouse conservation handbook. 2nd ed. English Nature. Peterborough

30th November 2017. Further details on survey methodologies and timings, as well as limitation and assumptions are provided in Appendix E9.

7.5.52 In 2018, a total of 50 nest tubes were positioned in suitable vegetation to include the stretch of land to the north of the main site, adjacent to Cypress Drive. Nest tubes were deployed in June and July 2018 using similar methodologies used in 2017 (as shown in Figure 1 in Appendix E10). Nest tubes were inspected every month between July and November 2018. Further details on survey methodologies and timings, as well as limitation and assumptions are provided in Appendix E10.

7.5.53 To better understand the population size and distribution of the dormice within the site, a repeat nest tube survey was undertaken in 2019 / 20 where a total of 333 nest tubes were placed within the study area in potential dormouse habitats in May 2019. An additional 50 tubes were deployed in August 2019 in an area where a possible dormouse nest was found during other ecological surveys on site, making the new total number of tubes deployed 383. Locations of nest tubes are shown on Figure 2 of Appendix E11. Deployment methods followed those described and used in 2017 and 2018 surveys.

7.5.54 Nest tubes were inspected for the presence of live dormice or signs of dormice (e.g. dormouse nest) over the course or two or three days approximately every month between May and November 2019. During the November survey, any tubes containing nests that may have been in use by dormice were left in situ. The nest tubes were then collected the following January 2020. Further details on survey methodologies and timings, as well as limitation and assumptions are provided in Appendix E11.

7.5.55 All surveys were undertaken by ecologists experienced in dormouse surveys, who either hold NRW survey licences or are accredited agents.

7.5.56 Further details on survey methodologies and limitations for all dormouse surveys are provided within Appendix E9 to E11.

Riparian Mammal Surveys

7.5.57 Riparian mammal surveys were initially conducted between June and November 2017 (Appendix E12). These were then updated between June and September 2019 (Appendix E13).

7.5.58 All 39 waterbodies identified within the survey area were subject to riparian mammal surveys in 2017 and 2019. Surveys were conducted between June and November in 2017 and comprising two survey visits to each waterbody in 2019; the first in June 2019 and the second in August / September 2019. Due to the

similarity in the survey methodologies for otter and water vole, the two surveys were combined and carried out simultaneously.

7.5.59 Surveys were executed in accordance with best practice guidelines for otter[30; 31; 32] and water vole[33;34]. The waterbodies surveyed are shown on Figure 1 of Appendix E12 and E13, and a further survey details are provided below and in Appendix E12 and E13.

7.5.60 Information was recorded during the surveys using standard recording sheets which were completed in the field using tablet devices. These had GPS mapping capability enabled to record the location of the waterbody, any relevant signs, features, and / or any photographs taken.

Otter

7.5.61 A habitat suitability assessment was undertaken at each waterbody to assess its suitability to support otter and to give an indication of how likely otters are to use a particular waterbody given the present habitat condition. Each waterbody was defined as being of high, moderate, low or negligible suitability for otter through assessing the shelter availability, food supply, modification and disturbance, hydrology, and pollutants.

7.5.62 The presence / likely absence of otter was determined at each waterbody by hand searching for the following field signs: spraints, anal jelly, holts, tar spots, laying–up sites, bank slides, runs, tunnels, prey remains and footprints.

7.5.63 Features that have high potential to be attractive to otters were also examined, this included: suitable bridges, bases of large trees, dense vegetation, crossings, confluences of water bodies, culverts and boulders.

Water Vole

7.5.64 A habitat suitability assessment was undertaken at each waterbody to assess its suitability to support water vole and to give an indication of how likely water vole are to use a particular waterbody given the present habitat condition. Each

[30] Chanin, P (2003) Ecology of the European Otter. Conserving Nature 2000 Rivers. Ecology Series No 10. EN, CCW, EA, SEPA, SNH & SNIFFER
[31] Crawford (2003) Forth Otter Survey of England 2000-2002. Environment Agency
[32] Strachan, R; Jefferies, D J (1996) Otter Survey of England 1991-1994: A report on the decline and recovery of otter in England and on its distribution, status and conservation
[33] Strachan, R; Moorhouse, T; Gelling, M (2011) Water Vole Conservation Handbook. 3rd ed. Wildlife Conservation Research Unit. Oxford
[34] Dean; Strachan, R; Gow, D; Andrews (2016) The Water Vole Mitigation Handbook. Mammal Society. London

waterbody was defined as being of high, moderate, low or negligible suitability for water vole based on the following criteria:

- Rate of water flow;
- Bank profiles;
- Degree of shading from overhanging trees;
- Extent of suitable emergent and bankside herbaceous vegetation in providing shelter, food and nesting material;
- Degree of cattle poaching (i.e. extent of damage to banks resulting from trampling by cattle);
- Levels of site disturbance, e.g. proximity to a Public Right of Way (PRoW), farm vehicle access tracks or road traffic;
- Potential for the water body to dry out;
- Suitability of bank substrates for burrowing; and
- Water quality.

7.5.65 The presence / likely absence of water vole was determined at each waterbody by thoroughly hand searching (every 1 metre) the bankside vegetation for the following field signs:

- Droppings (the most distinctive field sign to indicate recent use of a waterbody by water voles);
- Latrines;
- Feeding stations;
- Burrows; and
- Footprints.

7.5.66 Further details on survey methodologies and limitations for both otter and water vole are provided within Appendix E12 and E13.

Amphibian Survey

7.5.67 An amphibian survey was undertaken in 2017 by ecologists from Arup and Wildwood Ecology Ltd (Appendix E14). This was then updated in 2019, by a combination of Arup and Levan Ecology ecologists (Appendix E15).

7.5.68 A great crested newt habitat suitability index (HSI) assessment was undertaken at the same time as the Extended Phase 1 Survey in 2017 (see Appendix E1) and repeat in April and May 2019. The assessments were undertaken in line with best practice guidance[35]. The methodology however requires some adaptation for reens and ditches which characterise the Gwent Levels. This was achieved by discounting the ‘area’, ‘waterfowl’ and ‘pond density indices’ from the HSI

[35] Amphibian and Reptile Groups of the United Kingdon (ARG) (2010) Advice Note 5: Great Crested Newt Habitat Suitability Index

assessment. This adaptation of the methodology has previously been accepted by NRW on other projects which Arup have undertaken.

7.5.69 In 2017 and 2019, a total of 39 waterbodies were identified within the survey area; these waterbodies are shown on Figure 1 of Appendix E14 and E15.

7.5.70 The HSI is a numerical index which ranges from 0 and 1. It is calculated using ten key habitat criteria and is based on the assumption that the habitat quality determines great crested newt presence / absence. Using this standard approach, waterbodies with high scores are more likely to support breeding great crested newt than those with a lower score (see **Table 7.5**).

Table 7.5: Habitat Suitability Index

HSI	Pond suitability	Predicted occupancy
<0.5	Poor	0.03
0.5-0.59	Below Average	0.2
0.6-0.69	Average	0.55
0.7-0.79	Good	0.79
>0.8	Excellent	0.93

7.5.71 In order to confirm the presence / likely absence of great crested newt, a presence / absence survey was undertaken in 2017 comprised four surveys between mid-March and mid-June, with two surveys being between mid-March and mid-May. Four of the survey methods were employed:

- Torch survey;
- Bottle-trapping;
- Egg searching; and,
- Refuge search.

7.5.72 Each survey visit, comprised a visit at dusk to set out bottle traps, followed by torching. The following morning bottle traps were checked and collected, and any aquatic vegetation searched for the presence of newt eggs and carry out refuge searching. In accordance with the guidance[36], on each visit ecologist aimed to carry out at least three of the above survey methods where conditions allowed. For further detailed survey methodologies and limitations refer to Appendix E14.

7.5.73 Environmental DNA (eDNA) sampling was undertaken on all but three waterbodies in addition to the updated HSI assessments in 2019. Methodologies were in accordance with best practice guidelines and following the recommended methodology[37], within the optimum timeframe (survey dates were between the 29th April 2019 and 14th May 2019). Collected samples were sent to

[36] Froglife (2001) Great Crested Newt Conservation Handbook
[37] The use of environmental DNA test for Great crested newt licensing purposes. NRW

NatureMetrics Ltd for analysis. The three waterbodies not subject to eDNA sampling were as follows:

- Waterbody 4 – dry at the time of the visit, and therefore considered unsuitable for great crested newt;
- Waterbody 37 – initially returned an inconclusive result and was subsequently dry on the return visit to re-sample, and therefore considered unsuitable for great crested newt; and
- Waterbody 38 – almost dry at the time of the visit, and therefore considered unsuitable for great crested newt.

Badger Survey

7.5.74 A badger survey was undertaken within the 2017 survey area in September 2017 (Appendix E16). Any evidence of badger setts or other badger activity such as pathways, latrines or signs of foraging were recorded on digital maps and data forms, via a tablet computer, with accurate grid references logged via GPS. Survey methodology (including classification of any setts identified) was in accordance with standard best practice guidelines[38].

7.5.75 No badger setts were recorded during the 2017 badger survey. Furthermore, due to the low-lying nature of the area and the high water-table, the survey area is considered to have very low suitability for badgers to build setts. As such, an update survey was not carried out in 2019, and badger setts are considered to be likely absent from most of the survey area, although foraging badgers may be present. For full survey methodologies and limitations refer to Appendix E16.

Bird Surveys

Breeding Birds

7.5.76 Breeding birds were surveyed through a walked transect, with visits once a month in April, May and June 2017 (Appendix E17). The survey methods were derived from current best practice as described in Bird Census Techniques[39] and Bird Monitoring Methods[40], and conform to the recommendations of the Royal Society for the Protection of Birds (RSPB), the British Trust for Ornithology (BTO) and the JNCC.

7.5.77 The survey consisted of walking a pre-defined transect route that was representative of the range of habitats within the survey area that had the potential to support breeding birds, as described within the Breeding Bird Survey methodology contained within the above references. The survey transect route was

[38] Harris, S; Cresswell, P; Jefferies, D (1989) Surveying Badgers
[39] Bibby, C J; Burgess, N D; Hill, D; Mustoe, S (2000) Bird Census Techniques. Second ed. RSPB, BTO, Birdlife International, Ecoscope Applied Ecologists.
[40] Gilbert, G; Gibbons, D W; Evans, J (1998) Bird Monitoring Methods - a manual of techniques for key UK species. Sandy: Royal Society the Protection of Birds.

14.5km in length and aimed to cover woodland, scrub, waterbodies and grasslands, including edge habitat (shown on Figures 2 to 7 of Appendix E17).

7.5.78 The transect was surveyed each month between dawn and 10am when levels of avian activity (particularly singing) are likely to be at their highest. On one of the three visits the routes were walked in the opposite direction to the previous visit, to balance any temporal variation in behaviour levels.

7.5.79 The transect route was walked by a pair of suitably qualified Arup ecologists, at a slow pace, pausing briefly at intervals to listen for song and to scan for birds flying overhead or taking flight from the surrounding area. All birds seen and heard were mapped in accordance with the BTO standard activity recording codes.

7.5.80 Birds were considered to be breeding if any of the following applied:

- Birds were heard singing with habitat suitable for that species to breed within;
- A pair of birds were recorded in or near habitat suitable for that species to breed within;
- Birds exhibited territorial behaviour e.g. displaying or prolonged agitation;
- Birds were seen carrying food, nest material or the faecal sacs of young; or
- Nests, eggs and / or young were found to be present.

7.5.81 Where breeding signs were recorded, it is assumed that a ‘breeding pair’ was present and this term is used from this point forward within this chapter. For further details of survey methodologies and limitations refer to Appendix E17.

7.5.82 This survey was not repeated in 2019 as the habitats within the site had not significantly changed since 2017, nor had bird populations and / or distributions within south Wales.

Wintering Birds

7.5.83 Wintering birds were surveyed using the same transect survey methodology as was used for the breeding birds survey, but with different transect routes which were walked once a month from November 2017 to March 2018 (inclusive) (Appendix E18).

7.5.84 The transect route was 6.9km in length and covered areas that were representative of the suitable wintering bird habitat within the survey area, including Hendre Lake, other waterbodies and farmland (see Figures 2 to 7 of Appendix E18). The direction of the transect route was reversed between surveys to account for diurnal variation in wintering bird activity.

7.5.85 A number of bird species were specifically targeted during the wintering birds survey, including those listed as qualifying features of SPAs, Ramsar sites or SSSIs. Section 7 species and species listed on Cardiff Council’s LBAP Act were also recorded where possible. Species not defined as target species were recorded

as incidental. For further details of survey methodologies and limitations refer to Appendix E18.

7.5.86 This survey was not repeated in 2019 as the habitats within the site had not significantly changed since 2017, nor had bird populations and / or distributions within south Wales and / or in regard to the protected sites.

Reptile Survey

7.5.87 A reptile presence / likely absence survey was undertaken between August and October 2017 (Appendix E14). A total of 62 reptile refugia were installed on 23rd August 2017, two weeks prior to survey commencement to allow the refugia to settle and increase the chance of use by reptile populations. The positions of all refuges, and subsequent results, were recorded via GPS on tablet computers.

7.5.88 Seven survey visits were then carried out by suitably qualified Arup ecologists between 6th September and 4th October 2017, to check the artificial refugia, following standard guidance for reptile surveys[41]. In addition, any pre-existing suitable artificial or natural refugia within the survey area were also checked as part of the survey.

7.5.89 The artificial refugia were checked during early to late morning and / or early afternoon with a starting air temperature of between 13°C until a maximum of 20°C. Each refuge was lifted carefully to search for reptile species and, where feasible, details of the reptile species, sex, age class and condition of the reptiles encountered were recorded. Once the reptiles had been allowed to escape, the refugia were replaced.

7.5.90 Additional signs of reptile presence such as sloughed skins were also recorded where evident and any live animals observed away from refugia were also recorded.

7.5.91 Grass snake presence was confirmed during the 2017 reptile survey. An update survey was not carried out in 2019, as it was assumed that common species of reptiles, such as common lizard, grass snake and slow worm (*Anguis fragilis*) will be present within the survey area in areas of suitable habitat.

European Eel

7.5.92 No specific surveys for fish species were undertaken, however, the reens within the Gwent Levels are known to support a large population of European eel[42], and around the Gwent Levels, a number of tidal flaps have been modified to allow access for eels, and special eel passes have been added to a number of weirs[31]. Furthermore, European eel were recorded within the Ty Ffynon Reen (waterbody

[41] Froglife (1999) Reptile Survey: an introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Advice Sheet 10. Halesworth
[42] NRW (2015) SOUTH EAST Newport - Caldicot M4 Corridor National Fish Data

8, see Appendix E14) during the 2017 great crested newt presence / absence surveys.

7.5.93 As such, the assessment will be carried out based on the assumption that European eel are present throughout the reens on site.

Lamprey sp. (ammocoetes)

7.5.94 Whilst the study area is considered to be poorly connected to lamprey spawning grounds (areas of small stones and gravel in flowing rivers)[43], there is potential for this species group to be present. NRW considers that the reens and ditches of the Gwent Levels may potentially represent significant habitats for juvenile lamprey (ammocoetes) of all three species (river, brook and sea)[44]. Typically, juvenile lamprey live buried in mud in the margins of fast flowing rivers for three to five years during their development, however and may occur in smaller, silted watercourses.

7.5.95 As such, the assessment will be carried out based on the precautionary assumption that juvenile lamprey sp. (ammocoetes) have the potential to be present throughout the reens on site.

Invertebrate Surveys

Terrestrial Invertebrates

7.5.96 NRW recommended that a terrestrial invertebrate survey be undertaken within the survey area, with a particular aim to search for shrill carder-bee and brown-banded carder-bee. Both are Section 7 species and the former is Nationally Scarce.

7.5.97 The terrestrial invertebrate survey was carried out by Rachel Hacking Ecology Ltd, over three visits in 2019 (Appendix E19). Visits were conducted within the optimal time period for invertebrate surveys and to allow for the sample to include mid and late breeders / flying times. The visits took three days each due to the size of the proposed development and access arrangements: Visit 1 was carried out on the 24th to 26th June, visit 2 was carried out on the 24th to 26th July, and visit 3 was carried out on the 11th to 13th September.

7.5.98 The survey concentrated on the habitats identified within the Extended Phase 1 Habitat survey as having the potential to support a range of terrestrial invertebrate species, including semi-improved grassland, marshy grassland, ruderal vegetation and woodland edges. This resulted in a total of six survey sites within the survey area (see Figure 2 of Appendix E19).

7.5.99 The terrestrial invertebrate survey methods employed included sweep-netting, hand-searching, beating, pootering and suction sampling which aim to collect a range of small to large invertebrates. The survey focussed on specific invertebrate

[43] Maitland PS (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.
[44] Section 3.2.36, p. 14 https://gov.wales/sites/default/files/publications/2017-10/m4-corridor-around-newport-environmental-statement-appendix-10.18-aquatic-environment-baseline-study.pdf

orders which contain ecological indicator species: Diptera (true flies), Coleoptera (beetles), Lepidoptera (butterflies and day-flying moths), Odonata (damselflies and dragonflies), Hymenoptera (bees and wasps), Hemiptera (true bugs), and Araneae (true spiders).

7.5.100 All invertebrates caught were potted in 70% ethanol to be identified *ex situ* by various invertebrate specialists, unless identification could be made in the field, in which case the animal was released. The invertebrates recorded were then assessed for rarity designations[45;46;47;48].

7.5.101 For further survey methodologies and limitations see Appendix E19.

Aquatic Invertebrates

7.5.102 An aquatic invertebrate survey was carried out on the 26th and 27th July 2018, by David Clements Ecology Ltd and were sampled as far as possible in accordance with the guidelines provided by Natural Resources Wales, as described in Appendix E20. Aquatic invertebrate samples were collected at a series of stations within the survey area, each of about 50m in length where possible (see Figure 1 of Appendix E20), using a long-handled D-frame dipping net at approximately 5m intervals within each station.

7.5.103 Dipping at each interval comprised deep sweeping in the water about 6 times, taking care not to disturb the sediment. Net contents were emptied into a sampling tray for sorting on the bankside and relevant invertebrates were removed to tubes containing 70% ethanol solution for *ex situ* identification. Relevant invertebrates included aquatic representatives of: Coleoptera, Heteroptera, Ephemeroptera, Plecoptera, Trichoptera, Odonata (larvae), Selected Diptera families (larvae), Isopoda, Hirudinea and Mollusca.

7.5.104 In addition, where bankside and overhanging canopy vegetation was present within each station, this was swept using a long-handled sweep-net on an ad hoc basis. Relevant invertebrates were mostly collected dry to tubes or by pooter. Ad hoc searching beneath refugia such as stones and logs was also carried out where such features were present, with invertebrates being collected dry to tubes where suitable or, where soft-bodied, to 70% ethanol solution.

7.5.105 General sampling of terrestrial invertebrates was also carried out elsewhere within the survey area where suitable habitats were available, using the same sweep-netting method as above. Terrestrial sampling was mainly concentrated in the

[45] Falk, S J (1991) A review of the scarce and threatened Diptera of Great Britain. Nature Conservancy Council. Peterborough.
[46] Foster, G (2010) A review of the scarce and threatened Coleoptera of Great Britain, Part 3: Water Beetles. JNCC Peterborough.
[47] Hyman, P S; Parsons, M (1992) A review of the scarce and threatened Coleoptera of Great Britain, Part 1. JNCC Peterborough.
[48] National Biodiversity Network (www.nbn.org.uk)

areas of the aquatic invertebrate sampling stations, although ad hoc sampling was also carried out elsewhere when suitable opportunities presented themselves.

7.5.106 For further survey methodologies and limitations see Appendix E20**.**

Other Section 7 Species

7.5.107 The remaining Section 7 species, which are not protected under UK law, had no specific survey undertaken. However, suitable habitat to support Section 7 species such as hedgehog (*Erinaceus europaeus*) and polecat (*Mustela putorius*) and the species themselves were looked for during the Extended Phase 1 Habitat surveys and during all other ecological surveys. This habitat level assessment for Section 7 species is considered sufficient to assess any effects from the proposed development.

Assessment methodology

7.5.108 The assessment of impacts from construction and operation has followed the same methodology which is set out in the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland[13]. In line with this guidance, the following definitions are used for impacts and effects:

- Impact – Actions resulting in changes to an ecological feature. For example, the construction activities of a development removing a hedgerow.
- Effect – Outcome to an ecological feature from an impact. For example, the effects on a dormouse population from loss of a hedgerow.

Zone of Impact for Ecological Features

7.5.109 All plant and animal species, habitats and integrated plant and animal communities that occur within the 'zone of impact' of the proposed development are defined as potential 'ecological receptors'. The zone of impact for ecological features varies, depending on the nature and behaviour of the receptors, and also the type of impact that may affect them. In this chapter, the assessment of individual receptors is considered for the whole of the proposed development and in addition, the distances from the planning boundary listed in Table 7.6 below.

Table 7.6: Maximum Zone of Impact from proposed development Boundary for Ecological Features

Ecological feature	Maximum zone of impact from the planning boundary
Internationally designated sites, e.g. Special Areas of Conservation (SACs)	10km (expect for bat SACs which was extended to 30km)
Nationally designated sites, including Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs)	2km
Locally designated sites - Local Nature Reserves (LNRs) and Sites of Importance for Nature Conservation (SINCs)	1km
Fauna including amphibians, reptiles, mammals (excluding bats), birds, fish and invertebrates.	2km

Ecological feature	Maximum zone of impact from the planning boundary
Bat species	5km (except where features of European Sites then extended to 30km)

7.5.110 The maximum zone of impact for international sites was established at 10km due to potential hydrological impacts with the exception of effects on mobile bat populations where a 30km zone was used.

7.5.111 The zone of impact for nationally designated sites was considered to be 2km due to their importance and the inclusions of mobile species and hydrological connections which may give rise to affects.

7.5.112 For locally designated non-statutory sites, 1km was chosen as a maximum zone of impact given the non-statutory nature of their designation and the fact that these sites are generally designated for their habitat value rather than species, which could be impacted upon over a larger area; e.g. bats.

7.5.113 For fauna, it is largely the behaviour of species, including movement in the landscape combined with the nature of the development, which determines the 2km maximum zone of impact with the exception of bats where 5km was used to reflect the importance of foraging habitats within this distance of roosts.

7.5.114 The CIEEM guidelines recommend that the value of ecological receptors or features is determined based on a geographic frame of reference. For this assessment, the following geographic frame of reference is used:

- International;
- National (i.e. UK);
- Regional (i.e. South East Wales);
- County (Cardiff, Newport);
- Local (i.e. within circa 5km); and
- Less than Local (i.e. within the context of the proposed development and immediate vicinity).

Valuing Habitat and Species

7.5.115 In accordance with the CIEEM guidelines, in assigning a level of value to each habitat or species considered in the assessment, it is necessary to consider its distribution and status, including a consideration of trends based on available historic records. Rarity (including inclusion of lists of species of conservation importance, such as Red Data Lists, Birds of Conservation Concern, Biodiversity Action Plans and Lists of Habitats and Species of Principal Importance for the Conservation of Biodiversity: Section 7 Habitats and Species) is an important consideration because of its relationship with threat and vulnerability; although since some species are inherently rare, it is necessary to consider rarity in the context of status. A habitat or species that is rare or declining should be assigned a

greater level of importance than one that is rare but known to have a stable distribution or population.

7.5.116 Reference is also made to the biodiversity action plans listed in Section 17.3 above. The presence of a habitat or species on these lists generally reflects the fact that it is in a sub-optimal state; however, it does not necessarily imply any specific level of importance.

Predicting and Characterising Ecological Impacts

7.5.117 In accordance with CIEEM guidelines, when describing impacts, reference is made to the following:

- Magnitude - i.e. the size of an impact in quantitative terms where possible;
- Extent - i.e. the area over which an impact occurs;
- Duration - i.e. the time for which an impact is expected to last;
- Reversibility - i.e. a permanent impact is one that is irreversible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it. A temporary impact is one from which a spontaneous recovery is possible; and
- Timing and frequency - i.e. whether impacts occur during critical life stages or seasons and how often impacts occur.

7.5.118 Both direct and indirect impacts were considered: direct ecological impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through impacts on an intermediary ecosystem, process or receptor, e.g. a pollution event reducing the food source for a species such as otter or water vole.

7.5.119 The integrity of a site is defined within TAN 5[49] as: *"…the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and / or the levels of populations of the species for which it was classified."*

Significance Criteria

7.5.120 In accordance with the CIEEM guidelines, a significant impact, in ecological terms, is defined as 'an impact (whether 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, including cumulative and in-combination impacts'.

7.5.121 However, for consistency of assessments within this ES, the significance criteria and definition for each geographically values receptor has used those set out in Schedule 4 of the EIA Regulations[50]; being of negligible, minor, moderate and major significance. Where effects are classified as being of moderate and/or major

[49] Welsh Government (2009) Technical Advice Note 5: Nature Conservation and Planning. Cardiff
[50] Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (referred to as the 'EIA Regulations')

significance (either beneficial or detrimental), the effect is considered significant in EIA terms. Table 2.6 in Environmental Impact Assessment Chapter 2 of the provides a description for each of these criteria definitions.

7.5.122 Any significant impacts remaining after mitigation (the residual impacts), together with an assessment of the likelihood of success of the mitigation, are the factors to be considered against legislation, policy and development management in determining the proposed development.

Mitigation and Enhancement

7.5.123 It is important as part of any environmental impact assessment, wherever possible, to clearly differentiate between mitigation and enhancement. These terms are used in this assessment as follows:

- Mitigation is used to refer to measures to avoid, reduce or remedy a specific negative impact in situ; and
- Enhancement is used to refer to measures that would result in positive ecological impacts, but which do not relate to specific significant negative impacts or where measures are required to ensure legal compliance.

7.6 Limitations and assumptions

7.6.1 The findings presented in this assessment represent those at the time of survey and reporting, and data collected from available sources. Ecological surveys are limited by factors which affect the presence of plants and animals, such as the time of year, migration patterns and behaviour. Nevertheless, these surveys were conducted at the optimal survey periods and using methodologies which are widely accepted by NRW and other statutory bodies.

7.6.2 The results of the ecological survey allow evaluation of nature conservation value, assessment of the significance of potential impacts that may arise from the proposed development and consideration of appropriate mitigation measures. Every effort was made to ensure that the findings of the study present as accurate an interpretation as possible of the status of flora and fauna located within the planning boundary.

7.6.3 Any specific survey assumptions and limitations are detailed within the specific flora and fauna ecological reports provided in Appendix E1 to E20.

7.7 Baseline Environment

Designated Sites

Statutory Designations

7.7.1 The search using MAGIC highlighted four European sites and three national statutory designated sites within 10km and 2km of the proposed development, respectively. These comprised two SACs, one SPA, one Ramsar site, and three

SSSIs. A further three bat SACs were identified within 30km of the proposed development. All designated sites are detailed in Table 7.7. Figure 7.1 shows all international designations within 10km and bat SACs within 30km, and Figure 7.2 shows SSSIs within 2km.

Table 7.7: European Sites within 10km, bat SACs within 30km, and national statutory designated sites within 2km of the proposed development. Distances are approximate and are measured from the closest edge of each site.

Site name	Features	Distance and direction from proposed development (approx.)
European Sites (within 10km)		
Severn Estuary SAC	Annex I habitats that are a primary reason for selection of this site: – Estuaries – Mudflats and sandflats not covered by seawater at low tide – Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: – Sandbanks which are slightly covered by sea water all the time – Reefs Annex II species that are a primary reason for selection of this site: – Sea lamprey (*Petromyzon marinus*) – River lamprey (*Lampetra fluviatilis*) – Twaite shad (*Alosa fallax*)	1.1km south
Severn Estuary SPA	This site qualifies under Article 4.1 of the Directive (79 / 409 / EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: – Overwintering Bewick's swan (*Cygnus columbianus bewickii*) This site also qualifies under Article 4.2 of the Directive (79 / 409 / EEC) by supporting populations of European importance of the following migratory species: – On passage ringed plover (*Charadrius hiaticula*) – Overwintering curlew (*Numenius arquata*) – Overwintering dunlin (*Calidris alpina alpina*) – Overwintering pintail (*Anas acuta*) – Overwintering redshank (*Tringa totanus*) – Overwintering shelduck (*Tadorna tadorna*) The area qualifies under Article 4.2 of the Directive (79 / 409 / EEC) by regularly supporting an assemblage of at least 20,000 waterfowl.	1.1km south
Severn Estuary Ramsar site	Designated for the following Ramsar Criteria: – Ramsar criterion 1: Due to immense tidal range (second-largest in world), this affects both the physical environment and biological communities. – Ramsar criterion 3: Due to unusual estuarine communities, reduced diversity and high productivity. – Ramsar criterion 4: This site is important for the run of migratory fish between sea and river via estuary. Species include Atlantic salmon (*Salmo salar*), sea trout (*Salmo trutta*), sea lamprey, river lamprey, allis shad (*Alosa alosa*), twaite shad, and European eel. It is also of particular importance for migratory birds during spring and autumn. – Ramsar criterion 8: The fish of the whole estuarine and river system is one of the most diverse in Britain, with over 110 species recorded. The fish described	1.1km south

Site name	Features	Distance and direction from proposed development (approx.)
	above use the Severn Estuary as a key migration route to their spawning grounds in the many tributaries that flow into the estuary. The site is important as a feeding and nursery ground for many fish species particularly allis shad and twaite shad which feed on mysid shrimps in the salt wedge. – Ramsar criterion 5: Supporting an overwintering assemblage of up to 70919 waterfowl. – Ramsar criterion 6: Species / populations occurring at levels of international importance, including those mentioned in the SPA designation and greater white-fronted goose (*Anser albifrons*) and gadwall (*Anas Strepera*).	
River Usk SAC	Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: – Water courses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation Annex II species that are a primary reason for selection of this site: – Sea lamprey – Brook lamprey (*Lampetra planeri*) – River lamprey – Twaite shad – Atlantic salmon – Bullhead (*Cottus gobio*) – Otter Annex II species present as a qualifying feature, but not a primary reason for site selection: – Allis shad	6.7km north east
Bat SACs (within 10 to 30km)		
Mendip Limestone Grasslands SAC	Annex I habitats that are a primary reason for selection of this site: – Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: – European dry heaths – Caves not open to the public – *Tilio-Acerion* forests of slopes, screes and ravines Annex II species present as a qualifying feature, but not a primary reason for site selection: – Greater horseshoe bat (*Rhinolophus ferrumequinum*)	21km south
North Somerset and Mendip Bats SAC	Annex I habitats that are a primary reason for selection of this site: – Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) – *Tilio-Acerion* forests of slopes, screes and ravines Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: – Caves not open to the public Annex II Species that are a primary reason for selection of this site: – Lesser horseshoe bat (*Rhinolophus hipposideros*) – Greater horseshoe bat	24.6km south east

Site name	Features	Distance and direction from proposed development (approx.)
Wye Valley and Forest of Dean Bat Sites SAC	Annex II species that are a primary reason for selection of this site: – Lesser horseshoe bat – Greater horseshoe bat	26.3km north east
National sites (within 2km)		
Gwent Levels – Rumney and Peterstone SSSI	This site constitutes one of the most extensive areas of reclaimed wet pasture in Great Britain. The Gwent Levels reens are rich in plant species and communities, many of which are rare or absent in other Levels systems, including hairlike pondweed (*Potamogeton trichoides*), arrowhead (*Sagittaria sagittifolia*), flowering rush (*Butomus umbellatus*), brackish water-crowfoot (*Ranunculus baudotii*) and several regional rarities including the pondweeds *Potamogeton obtusifolius* and *Potamogeton berchtoldii*. The site also supports many nationally rare or notable aquatic invertebrate species, such as *Haliplus mucronatus* and *Hydrophilus piceus*. It is important for snails and dragonflies, including *Physa heterostropha* and *Brachytron pratense* respectively. The network of hedgerows and reen banks provide habitat for nationally important assemblages of terrestrial invertebrates such as *Pipunculus fonsecai*, *Tomosvaryella minima*, the marsh-flies *Pherbellia brunnipes* and *Lamprochromus elegans*, the water-beetle *Plateumaris braccata* and the variable damselfly *Coenagrion pulchellum*.	Lies within planning boundary
Severn Estuary SSSI	The Severn Estuary lies on the south west coast of Britain at the mouth of four major rivers (the Severn, Wye, Usk and Avon) and many lesser rivers. The immense tidal range (the second highest in the world) and classic funnel shape make the Severn Estuary unique in Britain and very rare worldwide. The intertidal zone of mudflats, sand banks, rocky platforms and saltmarsh is one of the largest and most important in Britain. The estuarine fauna includes: internationally important populations of waterfowl; invertebrate populations of considerable interest; and large populations of migratory fish, including the nationally rare and endangered allis shad. The SSSI forms the major part of a larger area of estuarine habitat, which includes the Upper Severn Estuary, the Taf / Ely Estuary and Bridgwater Bay.	1.1km south
Gwent Levels – St. Brides SSSI	In addition to the features already outlined above for the Gwent Levels – Rumney and Peterstone SSSI, the St. Brides area also supports 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 area 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.	1.3km east

Non-Statutory Designations

7.7.2 SEWBReC returned details of 14 non-statutory sites within 2km of the proposed development. These comprised one Wildlife Trust Reserve and 13 Sites of Importance for Nature Conservation (SINCs). The locations of non-statutory sites relative to the proposed development, as well as descriptions of these sites are

given in Table 7.8. Non-statutory sites within 2km of the proposed development are shown on Figure 7.2.

Table 7.8: Locally designated non-statutory sites within 2km of the proposed development

Site name	Description	Distance and direction from proposed development (approx.)
Marshfield SINC	This is an area of damp semi-improved neutral grassland, divided by ditches and hedges. The main plant species are creeping bent (*Agrostis stolonifera*) and Timothy-grass (*Phleum pratense*) with rushes, e.g. soft rush (*Juncus effusus*), and a moderate diversity of flowering herbs.	Lies within planning boundary
Hendre Lake SINC	Hendre Lake SINC is an artificial fishing lake with a small central island. In 2010 0.3ha of reedbeds were present, although they are grazed on by coot (*Fulica atra*) and Canada geese (*Branta canadensis*). The site is used by wintering bittern (*Botaurus stellaris*), little egret (*Egretta garzetta*) and Cetti's warbler (*Cettia cetti*). Otter and water vole have the potential to use the site.	Immediately west
Hendre Lake West SINC	This site is designated for its grassland habitat, which is distinct from the reen features of the Gwent Levels SSSIs. The eastern area encompasses a mix of damp semi-improved grassland, dominated by creeping bent, hairy sedge (*Carex hirta*) and greater bird's foot trefoil (*Lotus pedunculatus*) with a number of herb species. More westwards the habitat is dominated by grasses, e.g. Yorkshire fog (*Holcus lanatus*), creeping bent, Timothy-grass, false oat-grass (*Arrhenatherum elatius*) and perennial rye-grass (*Lolium perenne*), including a greater diversity of flowers, e.g. yellow rattle (*Rhinanthus minor*). Redshank and bittern have both been recorded here. Priority habitats include lowland meadow and purple moor grass and rush pasture priority habitats.	350m west
Hendre Road SINC	Hendre Road SINC is important for semi-improved neutral grassland dominated by coarse grasses, with localised rushes and stands of tall herbs, and marshy grassland, with soft rush, hard rush (*Juncus inflexus*), floating sweet-grass (*Glyceria fluitans*), sneezewort (*Achillea ptarmica*) and water purslane (*Lythrum portula*). The mosaic of habitats is completed by reens, hedgerows and small patches of scrub.	980m west
Tyla Farm Wood SINC	This site is an ancient semi-natural woodland split into two by the A48 (M). Streams with otter records are present within the site. Species indicative of the ancient semi-natural woodland have been recorded here including: scaly male fern (*Dryopteris affinis*), wood-sorrel (*Oxalis spp.*) and yellow pimpernel (*Lysimachia nemorum*). Green woodpecker has also been recorded here. This SINC has a high potential for dormouse, although none have ever been recorded here.	980m north
The Homestead SINC	This site is an area of unimproved neutral grassland.	990m north
Rumney Great Wharf SINC	Rumney Great Wharf SINC is an important site for birds, with species such as short-eared owl (*Asio flammeus*), great egret (*Ardea alba*), garganey (*Anas querquedula*), spotted redshank (*Tringa erythropus*), water pipit (*Anthus spinoletta*), and northern wheatear (*Oenanthe oenanthe*).	1km south-west
Cath Cobb Wood SINC	Cath Cobb Wood SINC is a secondary oak / ash woodland with a good shrub and ground layer, with many ancient semi-natural woodland indicator species including dog's mercury (*Mercurialis perennis*), pendulous sedge (*Carex pendula*) and yellow archangel (*Lamium galeobdolon*). A pond with characteristic aquatic and emergent plant species adds botanical and	1.1km west

Site name	Description	Distance and direction from proposed development (approx.)
	amphibian interest. The Faendre Reen passes through the woodland into Hendre Lake and the Wentloog Levels, creating damper areas adding to the variety of botanical interest.	
Sandy Lane Farm Field SINC	The Sandy Land Farm Field SINC is a semi-improved pasture, important for birds, neutral grassland, and invertebrates.	1.1km north-east
Peterstone Wentlooge Wildlife Trust Reserve	This reserve comprises rippling pools, marshy islands and mudflats stretching far out across the Severn Estuary. The site supports specialist coastal plants, like sea aster (*Tripolium pannonicum*), marsh mallow (*Althaea officinalis*) and sea milkwort (*Glaux maritima*). The site is important for wading birds that use it to feed and rest during migration, including dunlin, turnstones (*Arenaria spp.*), redshank, curlew, oystercatcher (*Haematopus ostralegus*), teal (*Anas crecca*), wigeon (*Mareca penelope*) and shelduck.	1.6km south-east
Druidstone Road SINC	Druidstone Road SINC comprises predominantly un-grazed fields of semi-improved neutral grassland, bordered on most of its sides by dense scrub woodland. There is a mix of tall ruderal herb vegetation and scrub along its south-eastern side. The grassland is relatively tall, with a high proportion of cock's-foot (*Dactylis glomerata*) and common bent (*Agrostis capillaris*). It includes a moderate diversity of plant species, and these include several usually associated with damp conditions, such as marsh thistle (*Cirsium palustre*), square-stalked St. John's-wort (*Hypericum tetrapterum*), greater bird's-foot trefoil and amphibious bistort (*Persicaria amphibia*).	1.6km north-west
Pant-Rhiw-Goch Wood SINC	This site is an ancient semi-natural woodland.	1.8km north
Coal Pit Lane Pond SINC	Coal Pit Lane Pond SINC is a mature pond with emergent vegetation, supporting reed beds, birds, amphibians, mammals and invertebrates.	1.9km north
Wentloog Industrial Park SINC	This site lies within the Gwent Levels: Rumney and Peterstone SSSI, though the grassland habitats of this SINC are distinct from the reen features of the SSSI. The site supports grazed semi-improved neutral grassland on a damp clay soil, bordered by ditches, hedges and scrub, and young planted trees atop an earth bund.	1.9km south-west

Extended Phase 1 Habitat Survey

7.7.3 The information described in this section is based on the results of the 2019 Extended Phase 1 Habitat Update Survey (Appendix E2). No major changes were identified between the 2017 and 2019 surveys, with the exception of the appearance and disappearance of a few hedgerows. However, this was shown to be a mapping error.

7.7.4 The survey area largely comprised arable and pastoral farmland intersected by a network of reens, which were occasionally shaded by or enclosed within a hedgerow. Approximately half of these fields were low-diversity heavily-grazed improved grassland (B4)[51] and arable land (J1.1). However, the other half were

[51] Habitat Phase 1 codes in brackets after the Habitat Phase 1 habitat type/name, and hereafter throughout the baseline results.

more species-rich fields, including poor semi-improved grassland (B6) and semi-improved neutral grassland (B2.2).

7.7.5 The semi-improved neutral grassland fields were all centrally located, immediately north and south of the railway line, partially forming the Marshfield SINC. Species recorded within these fields included pineappleweed (*Matricaria discoidea*), silverweed (*Argentina anserina*), perennial rye-grass, broadleaf plantain (*Plantago major*), black knapweed (*Centaura nigra*), bird's-foot trefoil (*Lotus corniculatus*), crested dog's-tail (*Cynosurus cristatus*), Timothy-grass, *Poa spp.* and Yorkshire fog.

7.7.6 Some of the marginal wetter areas adjacent to the reens supported rushes (*Juncus spp.*), reeds (*Phragmites spp.*), iris (*Iris spp.*), and sedges (*Carex spp.*). Yellow rattle was also recorded along the hedgerow running parallel to the railway. A relatively small area of willow (*Salix spp.*) carr wet woodland was recorded next to these fields south of the railway line. Wet woodland is a Section 7 and UKBAP Priority Habitat.

7.7.7 The poor semi-improved grassland fields had relatively high botanical diversity, despite being heavily grazed and / or poached in some places. Species recorded in these fields included Yorkshire fog, wall barley (*Hordeum murinum*), perennial rye-grass, cock's-foot, *Poa spp.*, soft rush, Timothy-grass, sweet vernal grass (*Anthoxanthum odoratum*), bird's-foot trefoil, creeping cinquefoil (*Potentilla repens*), crested dog's-tail, docks (*Rumex spp.*) and red clover (*Trifolium pratense*).

7.7.8 The network of reens (G1) that intersect the fields, and partially form the Gwent Levels – Rumney and Peterstone SSSI, had a variable extent of aquatic macrophyte cover, in particular common reed (*Phragmites australis*), bindweed (*Convolvulus*), sedges and rushes, with duckweeds (*Lemnoideae spp.*) and pondweeds (*Potamogeton spp.*) frequently recorded on the water's surface.

7.7.9 The reens within the site were occasionally shaded by or enclosed within a hedgerow. The most frequently recorded hedgerow type was native species-poor hedge with trees (J2.3.2), with species including willow and hawthorn (*Crataegus monogyna*). Native species-poor intact hedge (J2.1.2) and defunct hedge (J2.2.2) were also recorded relatively frequently, with species including willow and bramble.

7.7.10 Native species-rich intact hedgerows (J2.1.1) were relatively rare, with only one length recorded within the northern half of the proposed development. Species identified within this hedgerow were hawthorn, blackthorn (*Prunus spinosa*), crack willow (*Salix fragilis*), oak (*Quercus robur*), bramble, and rosebay willowherb (*Chamaenerion angustifolium*). All hedgerows are Section 7 and UKBAP Priority Habitats.

7.7.11 Other field boundaries that were recorded on occasion included fences (J2.4) and earth banks (J2.8). A line of mature planted coniferous trees (A3.2) were

identified on one occasion around a residential building to the north-east of the proposed development.

7.7.12 The habitats along the western boundary were a slightly more diverse mosaic of habitats, particularly those surrounding Hendre lake and stretching to the north between Cypress Drive and Faendre reen. Hendre Lake is the largest body of standing water (G1) within the survey area. Recreational fishing is common at designated spots around the lake, whilst some areas are designated for conservation, and as such fishing is prohibited. Some submerged aquatic vegetation was recorded within the lake, including a likely hornwort species (*Ceratophyllum spp.*).

7.7.13 The banks of the lake comprised a mosaic of particularly diverse mown / unmanaged poor semi-improved grassland verges (where the fishing stands are located), tall ruderal (C3.1) and dense scrub (A2.1). These lake-side grassland verges included Yorkshire fog, perennial rye-grass, cock's-foot, meadow foxtail (*Alopecurus pratensis*), cut-leaved crane's-bill (*Geranium dissectum*), white clover (*Trifolium repens*), red clover, common vetch (*Vicia sativa*), docks, rushes, and ragwort (*Jacobaea vulgaris*). The tall ruderal included common reed, bur reed (*Sparganium erectum*), bulrush (*Typha latifolia*), sedges and soft rush. The dense scrub included bramble, hawthorn, immature oaks, and elder (*Sambucus nigra*), with ivy (*Hedera helix*) encompassing some of the trees.

7.7.14 Semi-natural broadleaved woodland (A1.1.1) was recorded on the island in the centre of the lake, as well as surrounding the lake and stretching up to the north of the survey area. Species recorded within this habitat type included ash (*Fraxinus excelsior*), willow, mature oaks, alder (*Alnus glutinosa*), Scot's pine (*Pinus sylvestris*), bramble and hawthorn.

7.7.15 The woodland north of the lake between Cypress Drive and Faendre reen enclosed areas of marshy grassland (B5), poor semi-improved grassland, semi-improved neutral grassland (B2.2) and dense scrub.

7.7.16 The semi-improved neutral grassland was open with scattered willow and oak saplings (A3.1). Other species present included Yorkshire fog, hairy willowherb (*Epilobium hirsutum*), cleavers (*Galium aparine*), rosebay willowherb, cock's-foot, wavy hair-grass (*Deschampsia flexuosa*), common vetch, and cut-leaved crane's-bill. The marshy grassland was dominated by grasses, including Yorkshire fog and Timothy-grass, with extensive areas of rushes and reed, with creeping buttercup (*Ranunculus repens*), marsh thistle, and broadleaved dock (*Rumex obtusifolius*).

7.7.17 A small number of buildings (J3.6) were recorded within the survey area, atop tarmac / concrete hardstanding (J5). These were residential, buildings associated with the Ty-Fynnon Forge car body shop east of Heol Las, utilities structures

south-west of Cobol road, an electrical substation west of Heol Las, and farm buildings north of St. Mellons Road.

7.7.18 Results of the 2019 Extended Phase 1 Habitat survey are shown on Figure 7.3 and Figure 2 of Appendix E2 and are detailed further within Appendix E2.

Schedule 9 INNS

Desk Study

7.7.19 The only species listed under Schedule 9 of the Wildlife and Countryside Act 1981 recorded on site were the American mink (*Neovison vison*) (two records in 2009), Canada goose (99 records from 2008 - present), zebra mussel (*Dreissena polymorpha*) (one record from 2015) and red-eared terrapin (*Trachemys scripta*) (one record from 2016 in Hendre Lake).

7.7.20 Cherry laurel (*Prunus laurocerasus*) (two records in 2016) and harlequin ladybird (*Harmonia axyridis*) (two records from 2013 and 2016) were recorded in the near vicinity of the proposed development (within 150m of the planning boundary).

Field Survey

7.7.21 The survey area was searched for evidence of Schedule 9 INNS during both the 2017 and 2019 Extended Phase 1 Habitat surveys. Japanese knotweed was identified within the site boundary, generally located within woodland or along field boundaries. A waterweed (likely *Elodea* spp. or *Lagarosiphon* spp.) was also recorded at different locations within the reen system, and the floating aquatic water fern (*Azolla filiculoides*) was observed.

7.7.22 The results of the survey, including locations of INNS are shown on Figure 2 of Appendix E2, with more detail provided within the Extended Phase 1 Habitat Report in Appendix E2.

7.7.23 During the specific INNS survey in 2017, waterweeds (*Elodea sp.*) were recorded within most of the primary reens (Ty Ffynon Feen, Greenlane Reen and Pil-du-Reen where it enters Hendre Lake), which are permanently wet within the survey area. It is considered likely to be Nuttall's waterweed (*Elodea nuttallii*) due to the recurved leaves and the fold along the mid-rib. Not all waterweeds were examined to species level, however, all species of *Elodea* are listed as Schedule 9 plants.

7.7.24 Three stands of Japanese knotweed were identified across the survey area, and a single stand of hybrid Japanese knotweed was identified towards the west of the

survey area adjacent to Cypress drive. The locations of Schedule 9 plants identified are shown on Figure 1 of Appendix E3.

Vegetation Surveys

NVC Survey

7.7.25 The 2018 NVC survey confirmed the presence of a wide variety of vegetation types within the survey area. The main grassland habitat identified was MG5 grassland[52], with the examples found within the survey area varying between moderately species-rich MG5 (particularly in the Marshfield SINC and fields immediately north of the railway line) to species-poor MG5 grading to MG6. Several fields had not been grazed in the months or years preceding the autumn 2018 survey, and these were undergoing a succession to coarser and taller vegetation types that were generally species-poor, with common reed encroaching from the ditches and field grips in some areas.

7.7.26 The species composition of the plant communities examined in the NVC survey was mostly limited to common and widespread species, with a moderate botanical value in a local context, although the Marshfield SINC should continue to be regarded as having botanical value in a county context.

7.7.27 None of the plant species recorded are Section 7 species, or subject to special statutory protection under the WCA. However, three species were found that are listed as being locally notable in the Wildlife Sites Guidelines[53;54], including corky-fruited water-dropwort (*Oenanthe pimpinelloides*) (Primary Species) within Marshfield SINC, greater spearwort (*Ranunculus lingua*) (Primary Species) within a shallow scrap in unmanaged MG1 coarse grassland west of Faendre Reen, and meadow barley (*Hordeum secalinum*) (Contributory Species) frequent in most of the MG5 fields.

7.7.28 Devil's-bit scabious (*Succisa pratensis*) and trailing tormentil (*Potentilla erecta*) were recorded in the fields between Faendre reen and Cypress Drive and are of local interest. It is possible that other locally important plants were also present at a low density.

7.7.29 The greater spearwort and bogbean (*Menyanthes spp.*) within a shallow scrap in unmanaged MG1 coarse grassland west of Faendre Reen appear likely to have been planted, and as such, are not afforded any special nature conservation significance in this case as they could easily be replaced.

7.7.30 In addition to the species noted for their rarity, two Schedule 9 INNS were identified within the survey area: Japanese knotweed and giant knotweed

[52] NVC classifications codes used for describing plant communities.
[53] Under these guidelines a site is considered significant in a county context if it supports one or more Primary Species or five or more Contributory Species.
[54] Wales Biodiversity Partnership (2008) Guidelines for the Selection of Wildlife Sites in Wales.

(*Reynoutria sachalinensis*). Both species appear to have been introduced to the survey area through fly-tipped refuse.

7.7.31 A number of additional plant species were confirmed by the 2019 supplementary survey, and several of these are locally notable species that are important features of SSSI and SINC designations. This included pepper saxifrage and stone parsley, both of which are Contributory Species and were found within the Marshfield SINC, as well as soft brome (*Bromus hordeaceus*), fern grass (*Catapodium rigidum*), enchanter's nightshade (*Circaea lutetiana*), traveller's joy (*Clematis vitalba*), tufted forget-me-not (*Myosotis laxa*), water bent (*Polypogon viridis*), celery-leaved buttercup (*Ranunculus sceleratus*), black currant (*Ribes nigrum*), and goat's-beard (*Tragopogon pratensis*), all found within the SINC or the semi-improved grasslands to the west of the SINC immediately north of the railway line.

7.7.32 Further details of the 2018 and 2019 NVC survey are given in Sturgess Ecology's Vegetation Surveys Report 2018 and Vegetation Survey 2019 Addendum, in Appendices E4 and E5, respectively. Results are also displayed on Figure 3 of Appendix E4 and Figure 1 of Appendix E5.

Reen Flora Survey

7.7.33 The reens within the survey area included a good variety of aquatic plant species. The most notable species recorded (i.e. those listed as notable in Winder et al (1991)[55], or as Primary Species or Contributory Species in Wales Biodiversity Partnership (2008)[54]) included flowering rush, coontail (*Ceratophyllum demersum*), common frogbit (*Hydrocharis morsus-ranae*), small pondweed, sago pondweed (*Potamogeton pectinatus*), hairlike pondweed, great water dock (*Rumex hydrolapathum*), arrowhead, greater duckweed (*Spirodela polyrhiza*), and pink water-speedwell (*Veronica catenata*). These species were all recorded only within Primary reens to be retained, with the exception of the greater duckweed which was recorded in all reens surveyed.

7.7.34 Additional species of significance identified during the 2019 reen flora survey included curled pondweed (*Potamogeton crispus*), lesser pondweed (*Potamogeton pusillus*), gibbous pondweed (*Lemna gibba*), horned pondweed (*Zannichellia palustris*), star duckweed (*Lemna trisulca*), narrow-leaved water plantain (*Alisma*

[55] Winder, J; Spencer, J; Wood, A (1991) A botanical survey of reens of the Gwent Levels. CCW. Cardiff

lanceolatum), tubular water-dropwort, and brookweed (*Samolus valerandi*). Again, these species were recorded only within Primary reens to be retained.

7.7.35 The results of the reen flora surveys are further detailed within the 2018 and 2019 Vegetation Survey reports in Appendices E4 and E5, respectively. Some results are also shown on Figure 2 of Appendix E5.

Hedgerows

7.7.36 As described in Section 17.5, no specific surveys were undertaken to assess the hedgerows in relation to the criteria within the Hedgerow Regulations, due to the majority of hedgerows within the planning boundary being identified as species-poor. A total of 40 hedgerows were identified within the planning boundary during the Extended Phase 1 Habitat survey, totalling approximately 7.3 km in length, as follows:

- Native species-rich intact hedge (J2.1.1) – one hedgerow (225m);
- Native species-poor intact hedge (J2.1.2) – seven hedgerows (1.36km);
- Native species-poor defunct hedge (J2.2.2) – three hedgerows (394m); and
- Native species-poor hedge with trees (J2.3.2) – 29 hedgerows (5.34km).

7.7.37 Of these, dormouse presence was confirmed in 16 of the hedgerows in 2019, including the single species-rich hedgerow identified. These 16 hedgerows are therefore considered Important under the Hedgerow Regulations[56]. Hedgerows within the survey area are shown on Figures 7.3 and 7.4, and Figure 2 of Appendix E2.

Bat Surveys

Desk Study

7.7.38 The data search returned records of 10 species of bat and one species group within 5km: greater horseshoe bat, lesser horseshoe bat, serotine (*Eptesicus serotinus*), Daubenton's bat (*Myotis daubentonii*), whiskered bat (*Myotis mystacinus*), Natterer's bat (*Myotis nattereri*), Leisler's bat (*Nyctalus leisleri*), common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle (*Pipistrellus nathusii*) and brown long-eared bat (*Plecotus auritus*), as well as some unidentified Myotis bats (*Myotis spp.*), unidentified Pipistrelle bats (*Pipistrellus spp.*) bats and unidentified bats (Chiroptera).

7.7.39 There were 55 records of bat roosts within the search area. Three of these roosts were greater horseshoe bat and two were lesser horseshoe bat, all over 5.5km away (only provided to a 1km grid square resolution). The remaining roosts were: Daubenton's bat (2 roosts), whiskered bat (2 roosts), Noctule bat (3 roosts), common pipistrelle (19 roosts), soprano pipistrelle (3 roosts), brown long-eared bat (1 roost), unidentified *Pipistrellus spp.* (9 roosts) and unidentified bat (11

[56] In line with The Hedgerow Regulations 1997, a hedgerow is Important if it contains any species listed in Schedule 5 of the WCA.

roosts). The closest roost record to the proposed development was of a common pipistrelle roost approximately 367m west in a residential property in St Mellons.

Field Surveys

Roosts

7.7.40 A total of 142 trees and 86 groups of trees were recorded in the Arboricultural Survey Report (Appendix E6) and assessed as part of the GLTA in 2018 and 2019. Many of these trees / groups of trees were young, in good condition and did not offer any bat roosting potential.

7.7.41 The GLTA resulted in the following (results are from the 2019 GLTA unless stated otherwise):

- Six trees were found to have a risk of 2 (T5, T6, T7, T19, T52, and T140);
- Two trees were found to have a risk of 3 (T2 and T42);
- Two trees were found to have a risk of 4 (T16 and T31);
- Eight trees were found to have a risk of 5 (T21, T39, T41, G67, T97, T113, T114 and T132); and
- T4 was found to have a negligible BRP in the 2018 tree climbing survey and was not re-assessed in 2019.

7.7.42 During the dusk emergence surveys in June, July, and August 2019, no bat activity was detected as exiting from a roost location. No tree roosts for bats were identified during the 2018 and 2019 roost surveys combined. Barn owl presence was recorded from tree T114.

7.7.43 To the north of the proposed development there are three metal flat roof gas pumping station buildings, approximately 3m high with intact, sealed roofs. The vents were the only access points for potential bats but there were no signs of bat use identified on these features. These buildings were identified as having negligible bat suitability.

7.7.44 Roost survey results are further detailed within the 2017 / 2018 Bat Survey report and the 2019 Just Mammals Survey Report, in Appendices E7 and E8, respectively. BRP results are shown on Figure 4 of Appendix E7.

Bat Activity Transects

7.7.45 During the 2019 survey, the cypress transect along the western side of the survey area was generally the most active, excluding a dip in October, with a range of 21-43% of all the recordings made on this route. The middle and SINC transects were generally less active than others.

7.7.46 Species recorded within the survey area in 2019 included common pipistrelle, soprano pipistrelle, noctule, Daubenton's bat, Natterer's bat, Nathusius'

pipistrelle, long-eared bats and additional Myotis bats (where identification to species level was not possible). No Annex II species were recorded.

7.7.47 Common pipistrelle were the most frequently recorded species, by far exceeding the number of recordings for other species. Soprano pipistrelle bats were generally the second most frequently recorded. Noctule bat activity varied in terms of numbers of recordings, with none heard in October.

7.7.48 Daubenton's and Natterer's bats were recorded in low numbers through most of the transect survey sessions. The presence of Myotis bats overall was generally low. Recordings for long-eared bats (*Plecotus spp.*) were very few and only a small number of recordings were made for Nathusius' pipistrelle.

7.7.49 Apart from a dip in October, the cypress transect, along the western side of the site, was generally the most active with a range of 21% – 43% of all the recordings made on this route. The central bands of the site on the middle and SINC transects, were reasonably consistent in being less active as indicated by fewer recordings.

7.7.50 These results and species recorded were consistent with the 2017 survey; indicating the most active area to be the woodland and mosaic habitat between Cypress Drive and Faendre Reen. One additional species was recorded in 2017, being serotine with four passes recorded adjacent to Hendre Lake. No Annex II species were recorded in 2017.

7.7.51 A summary of activity on each transect is given in Table 7.9.

Table 7.9: Summary of transect survey results

Transect	Comments
Crop	Bats were recorded on most parts of the transect with the exception of the eastern part where very few bats were recorded. The business park at the northern end of the proposed development was brightly illuminated at night but there was regular bat activity on the fringe of the light zone. Foraging was observed along the hedgerows and tree lines within the transect and the habitat west of Faendre Reen was a regular foraging area.
Cypress	A regular passage of common pipistrelles were seen to fly over Cypress Drive near the northern end, from south to north suggesting the presence of a maternity roost in the area of houses to the west of Cypress Drive, in the vicinity of Pennyroyal Close. The habitat around the southern end of the transect within Hendre Lake Park recorded a good variety of bat species.
Middle	These fields recorded the presence of common pipistrelle, with occasional noctule bats, and very occasionally other species. Activity was generally light by comparison with other transects.
SINC	Similar to the neighbouring Middle transect with common pipistrelle presence dominating and other species providing a small level of diversity.
Southern	Apart from the dominant common pipistrelles, noctules were recorded at both east and west sections of the transect. Long-eared bats were recorded twice with very few myotis.

7.7.52 Results are shown on Figures 5 to 14 of Appendix E7 and Figures 8 to 13 of Appendix E8, with further results given in the 2017 / 2018 Bat Survey report and the 2019 Just Mammals Survey Report, in Appendices E7 and E8, respectively.

Static Bat Activity Monitoring

7.7.53 Relatively high levels of activity were recorded at each location with the exception of Location 6. Locations 2 and 3 (next to Faendre reen and on the only species-rich hedgerow leading off Faendre reen, respectively) recorded the most consistent high levels of bat activity across the survey period, with Location 3 recording the maximum BAI of 1883 in May 2017. Location 2 recorded a high level of activity in three of the recording sessions, with a maximum of 683 bat passes (equivalent) per night in June (see Figure 3 in Appendix E7).

7.7.54 Location 6 within the Marshfield SINC recorded only a low level of activity on all occasions and it is unclear why levels were so low at this location compared to the others across the survey area. This area of the SINC comprises species rich grassland with mature, overgrown hedgerows. However, it lacks the open water elements of the reens present at Locations 2, 3, 4 and 5, and livestock grazing is likely to be restricted to the aftermath period once hay has been cut when slightly higher activity levels were recorded post August.

7.7.55 Common pipistrelle were the most frequently recorded bat species across all locations, followed by soprano pipistrelle, noctule and Myotis bats. Myotis species were predominantly recorded in low levels with the exception of Location 3 in May when the activity level was considerably higher, with a BAI of 257.8, compared to the next highest BAI of 39.8 in October at Location 5 (on track sided by species-poor hedgerow with trees to the north of the SINC) see Figures 15 to 26 in Appendix E7.

7.7.56 Other species that were recorded much less frequently included Leisler's bat, serotine, Nathusius' pipistrelle and long-eared bats, see Figure 15 to 20 in Appendix E7. The only Annex II species recorded was barbastelle: one pass each at Locations 1 and 2 in May, and two passes at Location 6 in August. No

horseshoe bat species were recorded during the surveys. Further details are provided in Appendix E7**.**

Dormouse Survey

Desk Study

7.7.57 There were 11 records of dormouse provided, with the closest being of several nests within hedgerows (one occupied), including within conifers, located approximately 882m north from 2015.

Field Survey

7.7.58 A total of 12 tubes were found to contain confirmed or probable nests of dormice during the course of the 2017 surveys. These positive results were obtained from tubes in the east of the site within the Marshfield SINC, to the south of Faendre Reen near Hendre Lake, and between Faendre Reen and Cypress Drive. No live dormice were found in any of the nests.

7.7.59 Woodmice were frequently recorded within the nest tubes, and in November woodmice had destroyed a lot of the dormouse nests which had been made prior to that.

7.7.60 Signs of dormouse were encountered on two occasions in one tube located immediately north of the Cypress Drive / Newport Road / A48 / A48 (M) roundabout during the 2018 surveys. A live dormouse was encountered on one occasion in one tube immediately southeast of the roundabout. A single wood mouse nest was found during the 2018 surveys, located in the north-western corner of the proposed development. The location of tubes within the 2018 survey are shown in Figure 2 in Appendix E10.

7.7.61 Dormice or signs of dormice were encountered on a total of 225 occasions throughout the 2019 surveys, within 116 of the (380) nest tubes. Therefore, 31% of the nest tubes on site had been occupied by dormice. Live and / or dead dormice (as opposed to empty dormouse nests) were encountered within the tubes on 30 occasions. Four natural dormouse nests (outside of the dormouse nest tubes) were also identified during the January 2020 site visit to collect the remaining tubes.

7.7.62 A total of five dead dormice were found, between October 2019 and January 2020, within or adjacent to tubes 130 and139 both within Marshfield SINC, tube 188 and 353 east of Cypress Drive within the land north of Hendre Lake, and tube 289 east of Faendre reen close to the railway line. The reason for their deaths are unknown, though no signs of injury or disease were visible which could indicate that they died from starvation.

7.7.63 Dormice were recorded along numerous hedgerows where they had not been previously recorded during the 2017 surveys. The majority of hedgerows within the planning boundary were identified as species-poor, with the exception of one species-rich hedgerow running perpendicular to Faendre Reen. Dormice require a

diversity of trees and shrubs to ensure an unbroken sequence of foods available from spring to autumn, moving from flowers to fruits as they ripen across the seasons, with insects also playing an important supplementary role in their diet[29].

7.7.64 Despite this, dormice were recorded throughout the network of hedgerows immediately north and south of the railway, suggesting that the railway does not currently prove a significant barrier to their movement. They were also present within the stretch of woodland and connecting hedgerows along the east of Cypress Drive, spreading into the areas between Cypress Drive and Faendre reen.

7.7.65 The only areas they were not found was within the sparser defunct species-poor hedgerows further north and south of the railway, as shown in Figure 3 in Appendix E11.

7.7.66 From the high numbers of dormouse and/or nests recorded within the study area in 2019, the existing dormouse population within the proposed development is thought to be at or near carrying capacity, which would align with the high number of dead dormouse found. This could be influenced by the quantity and quality of the habitats present within the site, with limited species-rich hedgerows, hazel and broad-leaved woodland, but could also be due to the population appearing to be at its southern range, with limited suitable habitat and connectivity to the south, east and west of the proposed development.

7.7.67 Due to the high numbers recorded and the connectivity of suitable dormouse habitat, it is assumed that this species would be present in all suitable habitat within the planning boundary – i.e. woodland, hedgerow and scrub.

7.7.68 Wood mice or signs of wood mice were encountered on a total of 122 occasions throughout the 2019 surveys, within 87 of the nest tubes. Wood mice were often found later in the year to have inhabited nests that had been made and / or previously inhabited by dormice. Where a dormouse nest was present, this was recorded as a positive dormouse record.

7.7.69 Further results are provided in Appendix E11 and on Figure 3 of Appendix E11.

Riparian Mammal Surveys

Otter

Desk Study

7.7.70 Four records were provided in total for the search area. The closest record, which was also the most recent (from 2010) was of a spraint within the planning boundary along the reen adjacent to Cobol road. The other three records, from

2008, are of road traffic casualties on the M4. Otters are known to be present and have been recorded across the Gwent Levels and know to use the Severn Estuary.

Field Survey

7.7.71 Hendre Lake (waterbody 1), Faendre Reen (waterbody 2) and Green Lane Reen (waterbody 39) in particular were considered to have the highest suitability for otter in 2017 and 2019 surveys. They were all relatively large, held water year-round, supported larger fish, and had more opportunities for resting otter than others (Figure 2 in Appendix E12 and in Appendix E13).

7.7.72 A single sign of otter, being a potential otter couch recorded in the margin of an arable field alongside waterbody 4 in the north of the site in 2017, although this was revisited in 2019 and appeared to no longer be present. Numerous signs of otter were recorded across the survey area however in 2019:

- Six laying up sites were identified at five waterbodies (Hendre Lake island – waterbody 1; two on Faendre Reen – waterbody 2; Ty Ffynon Reen – waterbody 23; waterbody 33 south of the railway line and Greenlane Reen south of the railway line – waterbody 39);
- Spraints were identified at seven waterbodies (including Hendre Lake island – waterbody 1; Faendre Reen – waterbody 2, waterbodies 26, 30, 34, 35 and 39 adjacent to or perpendicular and connected to Green Lane Reen both north and south of the railway line;
- Footprints were recorded on one occasion ;
- Slides were identified at three waterbodies (multiple on Faendre reen – waterbody 2; one on the reen adjacent to Green Lane Reen south of the railway line – waterbody 39; and one on waterbody 35 perpendicular and connected to 39); and,
- Feeding remains in the form of freshwater mussel and / or snail shells were identified at two waterbodies (multiple on Hendre Lake island – waterbody 1; one on Ty Ffynon Reen – waterbody 8).

7.7.73 No holts or couches were identified at any waterbody during any survey visit during 2019.

7.7.74 Survey results are further detailed within the Riparian Mammal Survey report 2017 in Appendix E12 and 2019 in Appendix E13, with results shown on Figure 2 of Appendix E12 and Figures 2 and 3 of Appendix E13.

Water Vole

Desk Study

7.7.75 One record of a live sighting of water vole was returned from Hendre lake, from 2010.

Field Survey

7.7.76 Six waterbodies were recorded as high suitability to support water vole within the survey area in 2017. Three of these waterbodies remained of high suitability, two reduced to moderate suitability and one reduced to negligible suitability in 2019. Two waterbodies initially identified as moderate suitability in 2017 increased to high suitability in 2019, and an additional reen surveyed in 2019 was recorded as high suitability. All of these are Primary Reens managed by NRW, and therefore subject to regular management of the banks.

7.7.77 Reens which reduced from high to moderate suitability from 2017 to 2019 were Faendre Reen (waterbody 2) and Green Lane Reen north of the railway line (waterbody 7); waterbody 17 south of the railway line reduced from high to negligible. These differences are likely due to timing of maintenance activities making the waterbodies banks less suitable, and timing of survey.

7.7.78 Other reens which are subject to more regular maintenance were recorded with moderate suitability. A large number of waterbodies were however assessed as being of low or negligible suitability due to the presence of established and overgrown hedgerows which severely limit the availability of suitable foraging habitats and / or low to negligible water levels.

7.7.79 Water vole feeding stations were recorded on Ty Ffynon Reen and an adjacent and connected reen (waterbodies 8 and 32), while a probably sighting of a water vole was recorded on a primary reen south of the railway line (waterbody 18) in 2017.

7.7.80 Water vole field signs in the form of feeding stations and water vole burrows were recorded on only one of the primary reen (Green Lane Reen) south of Cobol Road (waterbody 26) in 2019, despite the two survey visits. No water vole latrines were identified alongside these burrows, and as such they could not be confirmed as active. A water vole feeding station was also identified outside of the riparian mammal survey area to the south-west during the Extended Phase 1 Habitat

survey on 16th July 2019, at approximate National Grid Reference (NGR) ST 24906 80236.

7.7.81 A further six potential water vole feeding stations were recorded along six waterbodies within the survey area, however, no water vole droppings were identified alongside these feeding stations. Bank vole feeding stations and latrines were present throughout waterbodies within the survey area, so it was therefore considered that these feeding stations were more likely to be bank vole, and as such are not mapped.

7.7.82 Despite presence of water vole only being confirmed along one waterbody in 2019, it is considered that water voles could be present across most of the survey area where suitable habitat is present, subject to grass cutting on the banks of the reen network. This is due to the presence of water vole being recorded along waterbodies 8, 18 and 32 in 2017, and the limitation of poached banks occluding field signs.

7.7.83 American mink scats were, however recorded on Faendre Reen (waterbody 2) and Green Lane Reen south of the railway line (waterbody 39), and further scats were recorded during other ecological surveys throughout 2019. The presence of mink are likely to have reduced the population of water vole in the area, which may explain the reduction in positive signs from 2017 to 2019, and are likely to be keeping the population minimal while present.

7.7.84 Results are further detailed within the Riparian Mammal Survey report 2017 in Appendix E12 and 2019 in Appendix E13, with results shown on Figure 3 of Appendix E12 and Figures 4 and 5 of Appendix E13.

Amphibian Survey

Desk Study

7.7.85 There were 31 records of amphibians from within the search area, including one record of great crested newt located approximately 950m north east of the proposed development. Other species recorded included palmate newt (ten records), smooth newt (one record), common frog (16 records) and common toad (19 records). The closest record was also the most recent (recorded in 2016) of a common toad (*Bufo bufo*) at Hendre lake. All other species were recorded more than 1km away.

7.7.86 A search of publicly available OS mapping and aerial imagery revealed a small number of potential standing waterbodies suitable for breeding amphibians within 250m of the planning boundary. Then the 2017 Phase 1 Habitat survey informed the need for HSI surveys.

Field Survey

7.7.87 Of the 39 waterbodies subject to a HSI assessment in 2017, 2 were good, 12 were average, 5 were below average and 5 were poor. A further 15 had no score or were not included due to accessibility, however these were either ditches with

hedgerows or dense vegetation which excluded visibility and as such are likely to have scored poorly. Presence absence surveys were undertaken on all water bodies which were of average or above suitability for great crested newts. Although four visits could not be undertaken on all water bodies due to inaccessibility due to vegetation growth or presence of cattle later in the season, it is considered that sufficient survey effort has been undertaken to have confidence in the validity of the results (see survey limitations in Appendix E3).

7.7.88 No great crested newts were recorded during the 2017 surveys. Smooth newt and palmate newt were recorded in waterbodies across the site and both north and south of the railway line, and common frog and common toad were recorded within Ty Ffynon north of the railway line, as shown in Figure 3 in Appendix E14. European eel was recorded during the 2017 surveys within Ty Ffynon reen (waterbody 8).

7.7.89 Of the 39 waterbodies subject to a HSI assessment in 2019, 9 were good, 10 were average, 9 were below average and 11 were poor suitability. All eDNA samples were returned as negative and great crested newt are therefore considered likely absent from the survey area.

7.7.90 These differences in the HSI between 2017 and 2019 are likely due to timing of maintenance activities making the waterbodies banks less and / or more suitable, the peening of the reens within the different years affecting the water level of the reens and possibly any effects the weather conditions on water levels of the reens.

7.7.91 Results are shown on Figures 2 and 3 of Appendix E14, and Figures 2 and 3 of Appendix E15, with further details given in the 2017 and 2019 amphibians survey reports in Appendices E14 and E15, respectively.

Badger Survey

Desk Study

7.7.92 Five records of badger were returned from the search area. The closest record was of a latrine and foraging signs, located approximately 1.2km north from 2014. The others comprised two records of setts and two records of road traffic casualties (on Bridge Road and the A48).

Field Survey

7.7.93 No badger setts were recorded during the surveys anywhere within the survey area. The only potential badger signs recorded were a large mammal trail within the Marshfield SINC, suspected to be from badgers and a likely badger latrine in the centre of the survey area. The locations of these field signs are shown on Figure 2 of Appendix E16.

7.7.94 The habitats present within the survey area are considered to provide suitable habitat for badgers to use for foraging, though due to the low-lying nature of the

area and the high-water table, the survey area is considered to have very low suitability for badgers to build setts. However, as described within the Limitations in Appendix E16, the railway line was not accessible for survey due to health and safety concerns and dense vegetation creating a barrier. Given that the railway line is on a slight embankment, and thus higher than the surrounding water table, the presence of badger setts along the railway embankment cannot be ruled out. However, no pathways were recorded in or out of the embankments which suggests no setts are present.

Birds Surveys

Desk Study

7.7.95 A total of 31 birds designated under Schedule 1 of the WCA were found within the search area. Of these, only three species are considered to have the potential to breed within the planning boundary, including barn owl, kingfisher (*Alcedo atthis*) and Cetti's warbler, which could nest in old trees within the planning boundary, bankside habitat or reedbeds / scrub at Hendre Lake, respectively. The other 28 Schedule 1 birds are unlikely to breed within the planning boundary, either due to a lack of suitable breeding habitat or because they are winter / passage bird species, e.g. redwing (*Turdus iliacus*).

7.7.96 SEWBReC also provided numerous records of Section 7 birds within the planning boundary, including lesser redpoll (*Acanthis cabaret*), bittern, black-headed gull (*Chroicocephalus ridibundus*), reed bunting (*Emberiza schoeniclus*), pied flycatcher (*Ficedula hypoleuca*), linnet (*Linaria cannabina*), grasshopper warbler (*Locustella naevia*), yellow wagtail (*Motacilla flava*), house sparrow (*Passer domesticus*), dunnock (*Prunella modularis*), bullfinch (*Pyrrhula pyrrhula*), starling (*Sturnus vulgaris*), and song thrush (*Turdus philomelos*).

Field Surveys

Breeding Birds

7.7.97 A total of 59 species were recorded during the three breeding bird surveys that took place across April to June 2017. A total of 36 species were considered to have bred within the survey area.

7.7.98 No species listed as qualifying features of nearby designated SPA and Ramsar sites were recorded within the survey area during the breeding season. Lesser black-backed gulls (*Larus fuscus*) were recorded, however, this species is only considered for future consideration on the Severn Estuary Ramsar site. Shelduck was noted which is listed as both a wintering species of the Severn Estuary SPA and a wintering and passage species of the Severn Estuary SSSI.

7.7.99 One species, Cetti's warbler, was recorded and assumed breeding that is included on Schedule 1 of the Wildlife & Countryside Act 1981. It is estimated that there are between 13 and 20 breeding pairs on site. Barn owl was recorded on several

occasions during the ecological surveys in 2019, further details are provided below.

7.7.100 A total of seven bird species were recorded that are placed on the UK Red List and six species that are recorded on the Welsh Red List; of these only seven species were assumed to be breeding within the site boundary (house sparrow, mistle thrush (*Turdus viscivorus*), skylark (*Turdus viscivorus*), song thrush, bullfinch, whitethroat (*Sylvia communis*) and willow warbler(*Phylloscopus trochilus*)).

7.7.101 Twelve species were recorded on the UK Amber List and eighteen species on the Welsh Amber List; of these six were assumed to breeding within the site boundary, with only ten species additional to those listed above (dunnock, mallard (*Anas platyrhynchos*), mute swan (*Cygnus olor*), reed bunting, coal tit (*Periparus ater*), coot, garden warbler (*Sylvia borin*), goldcrest (*Regulus regulus*), greenfinch (*Chloris chloris*) and long-tailed tit (*Aegithalos caudatus*)). The remaining species are Green Listed.

7.7.102 Nine Section 7 species were recorded, which are included on the UK and / or Welsh Red or Amber list above. No species were recorded, which are listed on the Cardiff LBAP.

7.7.103 Using the Guidelines for the Selection of Wildlife Sites in South Wales four species were observed on site, which are considered to be of conservation significance, but only Cetti's warbler was recorded as breeding. Only one species being the lesser whitethroat (*Sylvia curruca*), was recorded as being uncommon or rarer, with regards to the Gwent Ornithological Society's county status.

7.7.104 Results are discussed in detail by conservation status within the Breeding Birds Survey Report in Appendix E17. Results are shown on Figures 2 to 9 of Appendix E17.

Wintering Birds

7.7.105 In relation to the target bird species, a total of 21 species were recorded during the wintering bird surveys. No species listed as qualifying features of the Severn Estuary SPA or Ramsar site were recorded.

7.7.106 All 21 target bird species recorded are considered as waterfowl, being ecologically dependent on wetlands and thus contributing to the assemblage feature qualification of both the Severn Estuary SPA and Ramsar. A peak count of 659 target birds was recorded in February, representing 0.93 % and 0.70 % of the Ramsar and SPA assemblage population, respectively. See Appendix E18 for the list of species recorded.

7.7.107 One species, common snipe (*Gallinago gallinago*), is further listed for the Severn Estuary SSSI and a peak count of 55 was recorded within the study area in January 2017, primarily on the margins of the island in Hendre Lake and also in a

field immediately north of the train line (Point 5, Figure 7 in Appendix E18). Population figures are not provided for snipe in the Severn Estuary SSSI. Snipe were recorded in all months on site.

7.7.108 Two Section 7 species were recorded: golden plover (*Pluvialis apricaria*) and black-headed gull. No Cardiff County LBAP species were recorded.

7.7.109 Herring gull is the only target bird species recorded that is placed on the UK Red list. Golden plover, black-headed gull, woodcock (*Scolopax rusticola*) and herring gull are the only target birds on the Welsh Red List. Eight species were placed on the UK Amber List and eight on the Welsh Amber List. A number of incidental species were recorded which are placed on the UK and Welsh Red and Amber List. The remaining species are green listed.

7.7.110 Using the Guidelines for the Selection of Wildlife Sites in South Wales fourteen species were observed on site, which are considered to be of conservation significance. Little egret, water rail (*Rallus aquaticus*) and Cetti's warbler were the only species of wintering or passage bird on site of such significance to allow the designation of a Wildlife Site. Species which would contribute to that designation which were recorded on site include teal, golden plover, snipe, woodcock, skylark, kingfisher, peregrine (*Falco peregrinus*), stock dove (*Columba oenas*), reed bunting, kestrel (*Falco tinnunculus*) and stonechat (*Saxicola rubicola*).

7.7.111 Results are discussed in detail by conservation status within the Wintering Birds Survey Report in Appendix E18. Results are shown on Figures 2 to 7 of Appendix E18.

Barn Owl

7.7.112 It should be noted that there were regular sightings of barn owls during the 2019 bat surveys. At least three oak trees are considered to be potential nesting and/or roosting locations for barn owl. A veteran oak tree (TN11 on Figure 2 in Appendix E2 and T21 in Appendix E6) was suspected as a barn owl roosting location due to regular sightings of barn owl during bat surveys. Two owl pellets were found, and two barn owls were observed flying out of an oak tree (TN12 on Figure 2 in Appendix E2 and T114 in Appendix E6), which is therefore considered likely to be a barn owl breeding location. A further owl pellet was found at the base of another oak tree (TN13 on Figure 2 in Appendix E2 and T5 in Appendix E6). Figure 7.3 also shows the location of these three trees as potential barn owl nesting and/or roosting locations.

Reptile Survey

Desk Study

7.7.113 Records of three common reptile species were returned within the search area: slow-worm, common lizard, and grass snake. There were 12 records of slow-worm and five records of common lizard, with the closest records of both being in Marshfield approximately 750m north east from 2008. There were six records of

grass snake, with the closest being approximately 490m west in St. Mellons from 2016.

Field Survey

7.7.114 Grass snake were recorded on two occasions under one refuge in the north of the survey area (refuge number 121). This was a juvenile grass snake, approximately 15cm long. In addition, an adult grass snake was recorded basking on an area of grass during the deployment of the refugia. The locations of these records are shown on Figure 4 of Appendix E14. No other reptile species were recorded during these surveys. Common toad were recorded using the refugia in the west of the survey area.

7.7.115 During the 2019 Extended Phase 1 Habitat Update Survey (Appendix E2), a male common lizard was recorded resting within a fence post to the south of the railway.

European Eel

Desk Study

7.7.116 No European eel were recorded within the desk study search area. However, the reens are known to support a large population of European eel, which dominate the fish stocks in these features[57]. The results of two fyke net surveys, undertaken by Countryside Council for Wales (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. Furthermore, eel have been fished from Hendre Lake[59].

Lamprey and other Fish Species

7.7.117 No lamprey species were recorded within the desk study search area. However, NRW considers that the reens and ditches of the Gwent Levels may potentially represent significant habitats for juvenile lamprey (ammocoetes) of all three species (river, brook and sea)[58]. Typically, juvenile lamprey live buried in mud in the margins of fast flowing rivers for three to five years during their development, however and may occur in smaller, silted watercourses.

7.7.118 The reens are, known to support a mixed population of coarse fish, including roach (*Rutilus rutilus*), tench (*Tinca tinca*), bream (*Abramis brama*) and carp (*Cyprinus carpio*); all characteristic of slow-flowing or still water. 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) recorded roach, rudd (*Scardinius erythropthalmus*), perch (*Perca fluviatilis*) and three-spined

[57] CVJV/AAR (2015) Aquatic Environment Baseline Study - M4 Corridor around Newport - Environmental Statement Volume 3:
[58] Section 3.2.36, p. 14 https://gov.wales/sites/default/files/publications/2017-10/m4-corridor-around-newport-environmental-statement-appendix-10.18-aquatic-environment-baseline-study.pdf

stickleback (*Gasterosteus aculeatus*). Hendre Lake is also known to stock bream and carp, with mature eel and pike commonly being caught[59].

Field Surveys

7.7.119 As described above, no species-specific surveys were carried out for European eel, however an individual was recorded in Ty Ffynon Reen in 2017 during the great created newt surveys. As such the assumption is that a population of European eel is present throughout the reens within the planning boundary.

Invertebrate Surveys

Desk Study

7.7.120 Numerous Section 7 invertebrate species were recorded within the desk study search area, including: small pearl-bordered fritillary (*Boloria selene*), brown-banded carder-bee, shrill carder-bee, and dingy skipper (*Erynnis tages*). The closest of these were records of brown-banded and shrill carder-bee, both recorded at Hendre Lake in 2016.

Field Surveys

Terrestrial Invertebrates

7.7.121 A total of 235 species of terrestrial invertebrate were recorded across the survey area in 2019. The number of species recorded per taxonomic group are shown in Table 7.10.

Table 7.10: Total number of species per taxonomic group

Taxonomic group	Number of species
Diptera (true flies)	69
Coleoptera (beetles)	84
Lepidoptera (moths and butterflies)	15
Hymenoptera (bees, ants and wasps)	7
Hemiptera (true bugs)	44
Araneae	10
Odonata	6

7.7.122 No legally protected or Red Data Book species were found.

7.7.123 One Nationally Scarce species of terrestrial invertebrate was recorded. This was *Meligethes fulvipes*, a black pollen beetle which is found in marshy areas. It has

[59] https://clubfaw.weebly.com/hendre-lake.html#

scattered records across the UK and is found on the coast in South Wales. This species was swept from the tall, ruderal vegetation around Hendre Lake (Site 5).

7.7.124 A 'naturalised' species was recorded, within the damp grassland west of Marshfield SINC (Site 3; Figure 2 in Appendix E19). This was *Axinotarsus marginalis*, a flower beetle that has recently colonised the UK and is spreading north and west from its stronghold in the south-east. The NBN Gateway shows only one confirmed record for this species from Wales and that lies north of Usk. This species is currently uncommon in Wales.

7.7.125 No qualifying species for the Gwent Levels – Rumney & Peterstone SSSI were found on the site, nor were the shrill carder-bee and brown-banded carder-bee.

7.7.126 The most species-rich invertebrate site was Site 3, with a total of 100 terrestrial invertebrate species recorded, which corresponds to a greater number of flowering plant species in this habitat, compared to the other habitats. Site 6 (woodland edge, west of and adjacent to Faendre Reen, see Figure 2 in Appendix E19) recorded the lowest invertebrate species-richness with 43 species of terrestrial invertebrate recorded. This is due to the species-poor nature of the habitat and lack of multiple flowering species.

- Site 1 (small fields of semi-improved grassland, north of the railway line including part of the Marshfield SINC) – 73 species;
- Site 2 (a small pocket of marshy grassland west of Faendre Reen in Hendre Park) – 49 species;
- Site 3 (small fields of semi-improved grassland, which is mainly damp, to the north of, and adjacent to, the railway line, but west of Marshfield SINC) – 100 species;
- Site 4 (south of the railway line and comprises two linear fields of semi-improved grassland) – 52 species;
- Site 5 (a band of tall, ruderal vegetation at Hendre Lake) – 59 species; and
- Site 6 (woodland edge, west of and adjacent to Faendre Reen) – 43 species

7.7.127 The detailed results at each of the survey sites can be found in the Terrestrial Invertebrate Survey report in Appendix E19; Figure 2 of the report showing the location of each survey Site.

Aquatic Invertebrates

7.7.128 A total of 72 aquatic invertebrate species and 154 terrestrial invertebrate species were identified within the survey area during the 2018 aquatic invertebrate survey.

7.7.129 Numbers and diversity of aquatic invertebrates were assessed as being moderate to high, although this was mostly confined to Faendre Reen and Greenlane Reens, and the other larger reens which cross the survey area internally. Many of the

internal reens of the site were of much less interest, however, being extensively overgrown and / or dried-out at the time of survey.

7.7.130 Numbers and diversity of terrestrial invertebrates were assessed as being moderate to low over much of the survey area. The areas of neglected semi-improved neutral grassland and the tall bankside vegetation alongside Faendre Reen and, to a lesser extent, Greenlane Reen were considered to be the most valuable habitats for terrestrial invertebrates.

7.7.131 Numbers and diversity of both aquatic and terrestrial species were generally assessed as being greatest in the area of the proposed development lying north of the railway.

7.7.132 No legally protected or Red Data Book species were found, although the shrill carder-bee, could occur on the site having been recorded in similar habitats within Hendre Lake park in 2016.

7.7.133 Two Section 7 species were recorded within the survey area: brown-banded carder-bee and cinnabar moth (*Tyria jacobaea*). Two 'Nationally Scarce'[60] species were recorded: brown-banded carder-bee and crawling water-beetle (*Peltodytes caesius*). The brown-banded carder-bee was found on grasslands south of Ty-Ffynon Reen.

7.7.134 The detailed results at each of the survey sites can be found in the Aquatic Invertebrate Survey report in Appendix E20.

Other Section 7 Species

Desk Study

7.7.135 A total of 22 records of hedgehog were provided, with the closest being at Hendre lake from 2013. One record of brown hare (*Lepus europaeus*) was provided, located approximately 1.7km south west. Numerous Section 7 plant species were also recorded, including sea barley (*Hordeum marinum*), and tubular water-dropwort (*Oenanthe fistulosa*).

Field Survey

7.7.136 Species specific surveys were not undertaken for Section 7 species, however, habitat suitable to support a number of notable species was identified during the Extended Phase 1 Habitat surveys.

7.7.137 The network of hedgerows across the proposed development provide suitable habitat for hedgehog. The network of arable and pastoral fields with hedgerow boundaries provided suitable habitat for brown hare throughout the proposed development. The wet areas provide suitable habitat for common toad, and the

[60] 'Nationally Rare & Scarce' species are considered to be nationally rare or uncommon in the UK, but are typically not as rare as RDB species: These species are usually separated into 'Nationally Rare Na' species, which have been recorded in 15-30x 10km squares of the UK; and 'Nationally Scarce Nb' species have been recorded in 31-100x 10km squares of the UK, although they may just be listed as 'Nationally Scarce' where the data is insufficient to make this distinction.

woodland, marshy grassland and reen bank habitats provided suitable habitat for polecat.

7.8 Potential Impacts

7.8.1 A mixed use development such as this, including a new mainline train station, business park and associated infrastructure, can have potential impacts on ecology and nature conservation in a number of ways during both construction and operation.

7.8.2 The potential impacts to habitats and species may be both permanent and temporary, and direct and indirect. The direct effects are of habitat loss and severance, species mortality through vehicle collisions, habitat damage from changes in air quality, surface run-off and pollution events. Indirect effects are of displaced individuals on the occupancy of alternative habitat, including reduced foraging success, increased competition and predation, genetic isolation and inbreeding, which can lead to local extinctions.

7.8.3 A project-wide summary of the main potential impacts is provided below.

Habitat Loss

7.8.4 Habitats will be lost through the change of land use from countryside (predominantly farmland) to hard standing and buildings. The majority of habitat loss will be permanent, whereas for the areas that will be re-landscaped for green areas the loss will be temporary with the habitat reinstated and / or enhanced post-construction. Impacts will also occur on those designated sites that lie within the planning boundary, namely the Gwent Levels – Rumney and Peterstone SSSI and Marshfield SINC.

7.8.5 In general, permanent habitat loss, including that which supports key species, has been avoided through creation of replacement habitat, as described in Section 17.9 and Section 1.10. The indicative phasing strategy as described in Chapter 3, outlines how most of the embedded ecological design and planting will be undertaken within the initial phase, to allow these habitats to better establish prior to any associated habitat removal to facilitate development. Mature habitats will also be translocate as part of the proposed development. Replacement habitat will be designed in such a way that it is functionally connected and/or hydrologically connected to the wider ecosystem.

Habitat Severance

7.8.6 The proposed development is likely to sever some of the existing wildlife corridors and foraging areas, resulting in potential adverse effects on species populations in the area. Severance can lead to isolation both within and between populations and from specific resources vital for survival. The indirect effects of

this could include reduced foraging success, increased competition, genetic isolation and inbreeding, which can lead to local extinctions.

7.8.7 As above, habitat severance has been avoided through creation of replacement habitat, including wildlife corridors through the development, and wildlife crossings to allow safe crossings within the scheme as described in Section 1.10. Newly created reen habitat will be hydrologically connected to the Severn Estuary enabling it to be used by sea-going migrant fish as well as the common coarse fish assemblage.

7.8.8 Habitat severance will, however, still occur during site clearance and construction, but these effects can be reduced through the sensitive construction phasing designs and programming. Such severance effects can be further reduced through dead hedging[61] which can provide temporary habitat connectivity for protected species such as bats and dormice.

Habitat Damage

7.8.9 Habitats close to the proposed development, such as hydrologically connected aquatic habitats, are sensitive to effects from both construction and operation such as pollution events from fuel and chemical spills, from sediment run-off, from elevated levels of airborne dust and from the change in vehicle emissions due to increased use of the site. Whilst best practice construction and embedded operation design techniques for pollution prevention and control will be used, there is always a risk during construction and operation from vehicles and the transporting of potentially polluting goods.

7.8.10 Best practice control measures will be implemented and are detailed within the outline Construction Environmental Management Plan (outline CEMP) (see Appendix A2) which will be secured through planning conditions. Attenuation and drainage has been designed have to ensure no direct or indirect effects to the reen network of the Gwent Levels – Rumney and Peterstone SSSI as described in Section 17.9 and Section 1.10.

Species Disturbance

7.8.11 Disturbance effects from constructional activities and human presence, as well as noise, vibrations and lighting during both construction and operation of the proposed development could lead to significant impacts to sensitive species. This could lead to abandonment of territory or of young, increased predation risk and use of critical energy reserves. These effects would be avoided through specific embedded construction phasing designs and Method Statements that would address potential impacts on species. This would for instance include phased vegetation clearance to allow reptiles and other animals to disperse away from the

[61] When a proposed development involves the temporary removal of edge habitat such as woodland edges, hedgerows or tree lines, temporary structures ‘dead hedges’, can be used to provide connectivity and allow bats to continue along severed flight paths during construction. Such dead hedges may comprise a line of Herras fencing panels or similar with hessian stretched across them to provide a solid structure along which bats can commute. Such structures are only suitable to maintain connectivity for bats over relatively short distances. The structures can be moved during the day to accommodate construction activities, and then put back before dusk so that the mitigation is effective between dusk and dawn every night.

area, the removal of vegetation during the dormouse hibernation season and outside of the breeding bird season, and an ecological watching brief by an Ecological Clerk of Works (ECoW) to relocate dormouse hibernation nests. For dormouse particularly, this phased approach would also include a translocation strategy. Such mitigation is detailed below in Section 17.9, and within the outline CEMP (Appendix A2).

7.8.12 Disturbance to bats from lighting can lead to significant effects, such as severance and loss of foraging and commuting habitats, and a decline in airborne invertebrate prey. Operational lighting is proposed within key public spaces and will require higher illumination for public safety and to promote activity. However, light spill to sensitive ecological habitats will be avoided or reduced, where possible, to no more than 0.5Lux. Construction lighting will also need consideration and implementation of measures to reduce such impacts during construction, as detailed below in Section 17.9, and within the outline CEMP (Appendix A2).

Species Mortality

7.8.13 Species mortality can occur during construction as well as operation of the development. Less mobile species, or animals that are hibernating or have young, are likely to be most vulnerable to direct mortality during vegetation clearance and construction. The effects of individual mortality can lead to local extinctions once a population falls below a critical threshold. These effects are often greatest within longer-lived species, with greater parental investment and low annual reproduction, which struggle to recover from loss of family or population members.

7.8.14 As described above, these effects would be avoided through specific embedded construction phase Method Statements that would address potential impacts on species. Such avoidance techniques, including translocation strategies, are detailed below in Section 17.9, and within the outline CEMP (Appendix A2), and for protected species will be detailed and embedded within the relevant licences issued by NRW.

7.8.15 Many animals are killed by vehicle collision on UK roads each year and this is likely to be the case for the proposed roads within the scheme in the absence of embedded designs for wildlife. Animals that are particularly susceptible and are at risk from collision are badger, otter and bats due to the severance of wildlife corridors, and birds, especially barn owl, due to the way in which they hunt.

7.8.16 There are ecological design measures which can avoid and/or reduce the risk of collision such as hedgerow and tree planting along the roads to discourage species such as barn owl flying into the carriageways, and provisions of multispecies

crossings and fencing to ensure the save crossing of species such as otters and dormouse. Such embedded design measures are detailed below in Section 1.10.

7.8.17 Fish mortalities during construction will be avoided by undertaking a fish translocation prior to dewatering of reen habitat that will be lost (see Section 17.9).

7.9 Assumed Construction Practices and Licence Requirements

7.9.1 This section describes some established and uncontroversial standard best practice construction techniques and methods which will be employed to avoid or reduce the risk of potential impacts, in particular habitat damage, disturbance and species mortality. These are described within the outline CEMP (Appendix A2). The following paragraphs describe some of the measures which will be adopted to avoid or reduce potential impacts. These will be described in detail in the final CEMP and are listed in the outline CEMP (Appendix A2) which is submitted with the outline planning application. The adoption and implementation of these measures and best practice construction techniques will be secured through the submission of schemes to discharge appropriate planning conditions.

7.9.2 This section describes those licences which will and may be required to be obtained in advance of construction taking place. The licences are likely to include those necessary to mitigate impacts on European Protected Species and water voles. Licences will be issued by NRW and will include details of the measures, techniques and strategies to be adopted. This section is based on a series of assumptions for the measures, techniques and strategies which will conditioned as part of the licences, and these will be integrated into the working practices and methods for the construction.

7.9.3 In addition to that which is described below, the outline CEMP will also detail the requirement and timing required for pre-construction surveys for protected species (including badgers, bats, otters and water voles), an ECoW to, for example, oversee management of ecological issues as they arise, and to educate site personnel in ecological issues where needed.

Habitats and Plants

7.9.4 There is a risk that construction activities may inadvertently lead to dust, pollution events, or sediment run-off resulting in damage to those habitats (including designated sites and watercourses) that are within relative close proximity and / or are hydrologically connected to the construction footprint. These risks will be avoided or reduced through following standard best-practice techniques and methods which are summarised within the outline CEMP (Appendix A2) and in the Hydrology and flooding Chapter (Chapter 5).

7.9.5 Retained hedgerows and trees may also be at risk of root damage. These risks will be avoided or reduced through the implementation of the Arboricultural Method

Statement (AMS) and Tree Protection Plan (TPP) as detailed within the Appendix E6.

7.9.6 Due to the nature of the proposed development, in-stream works within the reens are unavoidable, and some reens will be lost. Risks to watercourses themselves have been further described and assessed within the Hydrology and flooding Chapter (Chapter 5). A buffer of 12.5m has been requested by NRW for all Primary Reens within the development during operation. Where possible, at least a 2m buffer will be provided between reen banks and construction activities or equipment in order to preserve the structural integrity of reen banks and to reduce the likelihood of construction run-off into reens. This will be achieved through protective fencing during construction to ensure no vehicle of people enter this buffer zone. This buffer will however only be compromised during the construction of road and pathway crossings over the reens.

7.9.7 The Primary reen to the east of the proposed development, Greenlane Reen, will require widening by 3m from the north eastern end of the planning boundary, where Cobol Road forms a junction with Heol Las, down to the agricultural access road located north of the gas pressure reduction station. This will be conducted under an Ordinary Watercourse Consent from Cardiff Council, and using construction methods which will be agreed through the method statement included within Ordinary Watercourse Consent during detailed design.

7.9.8 All proposed reen modifications will require in-channel works that have the potential to modify flow processes and sediment movement through bank failure, erosion, scouring and modification of geomorphological features. Changes to flow processes and sediment movement have potential for the washing of sediment into the reens. Clogging of the reens by silt will reduce in-stream habitat quality. The effects of siltation could be long term, as the low flow velocities in the reens may be insufficient to remobilise the silt and flush it downstream. Standard working practice to avoid and minimise risks to the hydromorphology of the reens are described in the outline CEMP.

7.9.9 Where instream works are required, they will be drained down under the supervision of an ECoW. As water levels decrease the speed of dewatering will be slowed to allow any fish or amphibians to be removed to suitable receptor locations (further details are provided in the fish and amphibian sections below). Where possible aquatic vegetation from drained waterbodies will be placed on the banks of retained reens and/or created reens for a minimum of 24 hours to allow invertebrates to move out of the vegetation.

7.9.10 Care will be taken during the draining down of waterbodies to adhere to the requirements of the Invasive Species Management Plan in relation to invasive aquatic plant species, as outlined in the outline CEMP (Appendix A2).

7.9.11 Schedule 9 INNS waterweeds (*Elodea spp.*) were identified within most wet reens within the survey area. Furthermore, a number of other Schedule 9 INNS were

identified throughout the course of the ecological surveys. These included Japanese knotweed, Himalayan balsam, variegated yellow archangel and giant knotweed, locations of which are presented in Figure 7.3. Under the Environmental Protection Act 1990, Schedule 9 INNS are considered controlled waste and therefore have to be disposed of safely at a licensed landfill if they need to be removed during construction. Further details of this are provided in the within the outline CEMP.

7.9.12 Temporary construction lighting required will be directional lighting and designed to ensure no light spill over 0.5 Lux[62] on to any identified retained or created habitats for dormice and / or commuting and foraging areas or bats. The principles of the lighting design is detailed within the outline CEMP, and details such as locations, types, Lux and positions, will be required for the final CEMP, secured through the planning application.

Dormice

7.9.13 All habitat to be cleared which has been identified as suitable dormouse habitat within this chapter and / or by the licenced dormouse specialist prior to clearance (i.e. hedgerows, woodland and scrub) will be removed under an EPS development licence obtained from NRW, details of the mitigation methods to be implemented under such a licence will be determined in consultation with NRW.

7.9.14 A dormouse strategy will be prepared to safeguard and move dormice out of areas to be cleared, which will detail methods and measures to be implemented during each phase of the clearance works. The initial phase of clearance works will require the removal of over 1km of hedgerow located immediately north of the existing railway, and a section of woodland to the south (see Chapter 3 and Figure 3.7 for more details on the indicative construction phasing). The Dormouse Conservation Handbook[29] states that displacement of dormice is the most appropriate option "where habitat loss can be limited to a strip of woodland/scrub less than 50m wide" or where "less than 100m of hedgerow would be removed". It then suggests that "where greater areas (or lengths of hedgerow) need to be removed in any one location and in any one season, then translocation of the animals should be considered"[29]. It is therefore considered that dormice will require translocating out of this area, due to the size of the area requiring clearance and that connections to and quality of the surrounding habitat are limited. Following the translocation of dormice, hedgerows and trees will be subject to the two-stage clearance method (see details in 7.9.17 below) to ensure that any remaining individuals are displaced into adjacent retained habitat.

7.9.15 Further to this, the existing dormouse population is thought to be at carrying capacity[63], due to the estimated population size and the number of dead dormice found, which are thought to have died from starvation. The population is also

[62] Industry standard based on various sources, including Bat Conservation Trust and Institute of Lighting Professionals (2018) Bats and artificial lighting in the UK. Guidance Note 08/18.
[63] The carrying capacity of an environment is the maximum population size of a biological species that can be sustained in that specific environment, given the food, habitat, water, and other resources available.

thought to be at its southern range limit, with limited suitable habitat and connectivity between the site and the Severn Estuary approximately 1.1km to the south, and with Cardiff approximately 4km to the west and Newport and the River Usk approximately 6km to the east of the proposed development. As such, translocation of dormouse may also ensure the survival of the existing population and support national dormouse conservation targets. The details of allocated receptor site(s) and parameters relating to the number of translocated individuals per translocation site will be agreed and secured through the EPS licence and any necessary landowner agreements.

7.9.16 Across the remaining development area, the phased approach to clearing the site up to a period of 4 years after commencement on site will allow for the remaining dormouse population to be moved into adjacent suitable retained and created habitats, through displacement methods. All habitats created for dormice will be planted in 'Phase 0' of the phased design, which will allow for a minimum of 4 years of growth before dormice are displaced into the habitats. New dormouse habitat will be created north of the railway line in the form of the 'Wildlife Corridor' and woodlands and hedgerows around the site, as well as in Hendre Lake park west of Feandre Reen. South of the railway line, new dormouse habitat will be created through woodland strips and hedgerows connecting to the wider hedgerow network. Habitats being created for nesting and foraging dormouse are shown on the Biodiversity Strategy (Figure 7.4), and the phasing of habitat creation and clearance is provided in Chapter 3 proposed development.

7.9.17 Vegetation clearance will follow the government's standing advice for dormice[64] and guidance from The Dormouse Conservation Handbook[29]. Due to the extent of habitat to be cleared a two-stage approach will be taken for clearance of all suitable dormouse habitat. This will comprise cutting of hedgerows and trees down to stump level (approximately 300mm) in winter (during the dormouse hibernation period) followed by removal of stumps in spring once dormice are active and foraging in adjacent alternative habitat.

7.9.18 All suitable dormouse habitat requiring clearance will be carried out under the supervision of an ECoW (named or accredited under the EPS licence) who will ensure no damage to dormouse hibernation nests and relocate them to alternative habitats where appropriate. The nature and location of the replacement habitats and timing of the vegetation clearance will all be in accordance with the EPS Licence Method Statement.

7.9.19 Habitat connectivity for dormouse will need to be maintained during construction, this will be achieved through dead hedging[65] and use of dormouse bridge

[64] https: / / www.gov.uk / guidance / hazel-or-common-dormice-surveys-and-mitigation-for-development-projects#mitigation-and-compensation-methods

[65] When a scheme involves the temporary removal of edge habitat such as woodland edges, hedgerows or tree lines, temporary structures 'dead hedges', can be used to provide connectivity and allow protected species, such as dormice and bats, to continue along severed habitat and flight paths for bats during construction. Such dead hedges for dormice and bats uses brash from cut and cleared vegetation piled in a line in a similar shape and function as a hedgerow. For bats only dead hedges may comprise a line of Herras fencing panels or similar with hessian stretched across them to provide a solid structure along which bats can commute. Such structures are only suitable to maintain connectivity for bats over relatively short

structures[66]. Appropriate exclusion zones from existing and retained dormouse habitat will be established and enforced to ensure no disturbance impacts to the retained population. Further details of these construction mitigation strategies for dormouse will be detailed within the EPS licence for dormice.

7.9.20 Temporary construction lighting required will be directional lighting and designed to ensure no light spill over 0.5 Lux on to any identified retained or created habitats for dormice. This is detailed within both EPS licence and the outline CEMP (Appendix A2) and will be secured through the planning application.

Bats

7.9.21 No bat roosts were identified within the survey area, but the proposed development will nevertheless result in the loss and severance of commuting and foraging habitats, as well as disturbance of commuting and foraging bats.

7.9.22 Pre-construction surveys will be conducted to establish whether any trees or buildings previously identified as having BRP have become roosts, at which point any tree or building roosts to be removed will be done so under an EPS development licence obtained from NRW, with a replacement roost provided.

7.9.23 Trees where the potential for roosting bats cannot be ruled out after the pre-construction survey will be soft felled, in accordance with methodology outlined in the outline CEMP (Appendix A2). Disturbance licences may also be required for any building or tree roosts within 50 metres of construction, depending on the type of roost, environmental factors and type of construction activity within the area.

7.9.24 Key commuting and foraging routes for bats, which were found to be in the habitat next to, and along, Faendre reen and on the only species-rich hedgerow leading off Faendre reen (with low to negligible activity recorded across the rest of the site), will be retained for as long as possible in the works programme and will be phased through the phasing design (see Chapter 3 for details of the indicative construction phasing). Dead hedges[65] will be used to allow bats to continue using key commuting routes to maintain connectivity to adjacent foraging habitats (see the outline CEMP for further details). Works with a high level of noise and vibration will be timed sensitively to the bat activity period, if any bat roosts are identified during the pre-construction surveys.

7.9.25 Temporary construction lighting required within bat activity periods will be directional lighting and designed to ensure no light spill over 0.5 Lux on to any

distances. The structures can be moved during the day to accommodate construction activities, and then put back before dusk so that the mitigation is effective between dusk and dawn every night.

[66] https: / / animexbridge.com /

identified commuting and foraging areas. This is detailed within the outline CEMP and will be secured through the planning application.

Otter

7.9.26 An EPS development licence from NRW will be obtained for the loss of and / or disturbances to otter resting sites within the planning boundary, and a pre-construction survey for otter will be carried out as detailed within the outline CEMP (Appendix A2) to ensure there are no new otter breeding or resting places within the construction footprint of the proposed development.

7.9.27 Night-time works could disturb resting, foraging or commuting otters within approximately 50m of the proposed development, and up to 200m for resting otter places[67]. Details on work timings to reduce disturbance to otters and badgers will depend on the pre-construction results and development licence requirements; any restrictions will be within the final detailed outline CEMP.

7.9.28 Any open excavations during construction should be covered at night or a means for escape such as ramps provided to reduce the risk of trapping or injuring otters, and a buffer zone should be maintained around watercourses at night to avoid unnecessary adverse impacts to otter as detailed within the outline CEMP.

7.9.29 As mentioned above all primary reens will have a protected buffer zone established and fenced during construction of at least 2m, where possible. Standard good working practices to avoid damage to the banks of watercourses or wetland habitat during construction will be employed, as detailed above and within the outline CEMP.

Water Vole

7.9.30 Water vole presence was not confirmed in 2019 along any reen due to be removed, though presence was confirmed in 2017 and on adjacent reens in 2019. Pre-construction surveys should be conducted to establish the presence of any water vole burrows not previously identified.

7.9.31 If burrows are identified along reens due to be removed, habitat manipulation strategies will be prioritised over capture and translocation. Vegetation along the banks of reens to be removed will be strimmed or turf stripped to make the habitat unsuitable for water voles, causing them to relocate away from the area. De-watering the reens may also be used to degrade the habitat further. Displacement should always include a destructive search. The deliberate displacement of water voles must be undertaken under a licence issued by NRW.

7.9.32 Displacement should take place in late winter / early spring when population numbers are lowest, and animals are already pre-disposed to move as they begin

[67] Forest Research, Forestry Commission (England, and Corporate and Forestry Support Division) and Natural England (2013) Guidance on managing woodlands with otter in England. Version 2.

to establish breeding territories: this period is defined as between the 15th February and 15th April for most of Wales. During the breeding season it is likely that females are more sedentary due to the presence of young. Water voles are also more sedentary in the winter and less responsive to habitat changes. The effectiveness of displacement in autumn is unknown but is considered less likely to be effective than spring displacement due to the higher densities of animals at this time of year, and as breeding can continue until late in the season. In addition, water voles store food below ground during the autumn, and displacement at this time could put animals at greater risk of winter mortality[34].

7.9.33 Details of water vole displacement are included within the outline CEMP (Appendix A2). As mentioned above all Primary Reens will be have a protected buffer zone established and fenced during construction of at least 2m, where possible. Standard good working practices to avoid damage to the banks of watercourses or wetland habitat during construction will be employed, also detailed within the outline CEMP.

Amphibians

7.9.34 No great created newts where found during the presence / absence survey in 2017, nor during the eDNA sampling in 2019. Nevertheless, other amphibians were recorded as present within the reen network, including smooth and palmate newts, common frog and Section 7 common toads. As such, where instream works are required, reens will be drained down under the supervision of an ECoW. As water levels decrease the speed of dewatering will be slowed to allow any amphibians to be removed to suitable receptor locations outside of the construction footprint. This is further detailed within the outline CEMP (Appendix A2).

7.9.35 Pollution which effects the water and / or associated terrestrial habitats could negatively impact amphibian species. The risk of such pollution events are reduced by the implementation of the pollution prevention measures as described in outline CEMP.

7.9.36 All other terrestrial habitat clearance will be conducted in a staged and sensitive manner to allow individuals to move out the area in to existing habitats (habitat manipulation, as detailed in the Reptile section below and within the outline CEMP) or an ECoW will be present to remove any individuals to areas of safety. This will either be reens being retained or existing and/or created habitats suitable to support amphibians, such as created stone and/or log pile hibernacula within the Wildlife Corridor (see Figure 7.3 Biodiversity Strategy).

Badger

7.9.37 As described above, badger setts are considered likely absent from the proposed development, although foraging and commuting badgers may be present. A pre-construction survey will however be undertaken within the proposed development and within at least 50m of all proposed works to determine if any badger setts have been created. This survey should be conducted within 3 months of the works commencing, and as such these surveys will need to be phased in relation to

phased design of construction. Any badger setts found will be to be closed or assessed for potential disturbances and a badger development licence from NRW will be obtained as required.

7.9.38 Night time works could disturb foraging or commuting badgers within approximately 50m of the proposed development. Details on work timings to reduce disturbance to badgers will depend on the pre-construction survey results and any development licence requirements; any restrictions will be detailed within the final CEMP.

7.9.39 Any open excavations during construction should be covered at night or a means for escape such as ramps provided to reduce the risk of trapping or injuring badgers, as detailed within the outline CEMP (Appendix A2).

Birds

7.9.40 Vegetation clearance undertaken during the bird breeding season (March to September)[68]) will require sensitive working methods to ensure no active nests are damaged or destroyed in accordance with the WCA 1981. If vegetation clearance is required during the breeding bird season, an ECoW will be appointed to carry out a nesting bird check on any vegetation to be cleared, or vegetation directly adjacent to major works, no more than 24 hours prior to works commencing. If an active nest is identified, a suitable buffer shall be implemented around the nest with no works occurring within this buffer until the young are fully fledged, see the outline CEMP (Appendix A2) for further details.

7.9.41 Barn owl were confirmed to present within the site in 2019, using at least three oak trees in the north of the site, as shown in Figure 7.3. One of these oaks was considered to be a potential nesting site (TN12 on Figure 2 in Appendix E2 and T114 in Appendix E6), the other two are likely to be secondary nest sites and / or roosting sites of the same pair (TN11 and TN13 on Figure 2 in Appendix E2, and T21 and T5 in Appendix E6). The latter two trees (not the possible breeding site) will be lost through the proposed development, as shown in the Biodiversity Strategy Figure 7.4 and within the Arboricultural Method Statement (AMS) and Tree Protection Plan (TPP) as detailed within the Appendix E6.

7.9.42 A pre-construction survey will be required to determine the status of the barn owl population within the site and adjacent habitat. Barn owl are Schedule 1 species of the WCA 1981 which affords them extra protection from disturbance during the breeding season. As such tree removal and any other disturbance activities within the vicinity of identified breeding sites and roosting sites will need to be sensitively timed and only after alternative provision have been provided, such as barn owl nesting boxes. The barn owl nesting boxes, likely to be three if all three potential nesting and/or roosting sites are confirmed during the pre-construction

[68] Natural England and Defra (2015) Wild birds: surveys and mitigation for development projects. Standing advice for local planning authorities to assess the impacts of development on wild birds. https://www.gov.uk/guidance/wild-birds-surveys-and-mitigation-for-development-projects [Accessed 28/01/2020]

surveys, will be positioned under the guidance of the ECoW south of the railway line in the mitigation areas away from any disturbances and proposed development. Further details on the provision and suggested locations of bird nesting boxes are provided in Section 7.12.

Reptiles

7.9.43 Grass snake presence was confirmed in two out of the three areas surveyed, to the north and west of the proposed development. Both of these areas are being affected by some habitat loss and severance from the construction of the access routes into the site; although adjacent suitable habitats are being retained in these areas. The survey concluded, however, that common species are likely to be present in small numbers within suitable habitat throughout the proposed development and should therefore be considered during construction.

7.9.44 Due to the likely low population density, habitat manipulation and displacement strategies will be prioritised over exclusion fencing and translocation strategies. The phased design of the proposed development will allow for reptiles to be strategically moved out of areas into existing habitat and / or newly created habitats which would have established due to the phasing.

7.9.45 Within grassland areas suitable for reptiles, the height of the sward will be reduced in stages within the construction area to encourage animals to move out of the footprint of the proposed development (habitat manipulation). The use of this method may vary depending on the time of year and ambient temperatures. Reptile enhancement features such as stone and / or log pile hibernacula will be provided in the habitat adjacent to that being removed to encourage the movement of, and provide enhanced habitats for, the reptiles. Depending on the area being cleared within the phasing this is likely to be the retained habitats within Hendre Lake park or Wildlife Corridor.

7.9.46 Only if required one-way exclusion fencing will be used to prohibit reptiles returning to the construction area. This approach would be detailed within the final CEMP. Reptiles encountered will be carefully moved out of the construction areas to suitable receptor areas outside of the construction footprint. Reptile habitat to be retained will be appropriately marked and fenced if required. These strategies will be detailed within the final CEMP for each area where reptiles are likely to be present.

European Eel and Fish Species

7.9.47 Where instream works require dewatering, reens will be drained down under the supervision of an ECoW with a background in freshwater ecology and fisheries. The ECoW role will involve overseeing the dewatering process and fish translocation to move fish from impacted reens to suitable habitat elsewhere; this would involve managing the drawdown rate based on the abundance of fish through liaison with the fish translocation team. As water levels decrease dewatering will be slowed to allow any fish or amphibians to be removed to suitable receptor locations. Fish (and amphibians) would likely be translocated to

Primary reens (Feandre and Greenlane reens) located to the east, west and south of the proposed development but this would be agreed in advance with the local NRW fisheries/biodiversity officer.

7.9.48 The fish translocation (including European eel and lamprey species *ammocoetes*) would take place as prior to dewatering in order to move fish from impacted reens to suitable habitat outside the construction footprint. Netting and/or electric fishing techniques would be used requiring a Salmon and Freshwater Fisheries Act (SaFFA) Section 27 exception to "use fishing instruments (other than rod and line) and/or remove fish from inland waters" from the NRW.

7.9.49 It is recommended that works in watercourses containing lamprey should only be carried out during the period August to September (except in the case of exceptional circumstances). Translocation and instream works including habitat creation should be undertaken outside of the lamprey spawning season (river and brook lampreys spawn during the period March-April, while sea lamprey spawn during the period May-August)[69].

7.9.50 Pollution events which could affect waterbodies could negatively impact European eel and other fish species. The risk of this occurring will be avoided and reduced through the implementation of the pollution prevention measures as described in outline CEMP (Appendix A2).

Invertebrates

Aquatic Invertebrates

7.9.51 Where instream works are required, they will be drained down under the supervision of an ECoW. Where possible aquatic vegetation from drained waterbodies will be placed on the banks of retained and/or created reens for a minimum of 24 hours to allow invertebrates to move out of the vegetation. In-stream works for aquatic invertebrates is also best during the summer months to avoid losses of larval species present in spring.

Other Section 7 Species

7.9.52 Habitat clearance and habitat manipulation techniques will be designed to be sensitive to other Section 7 species and to deter species away from construction areas. Suitable alternative habitat will be identified away from the construction footprint and activities and provided for any Section 7 species found during construction. Section 7 species will be moved to these areas by an ECoW. Habitat

[69] https://lampreysurveys.com/timing-of-instream-works/

clearance and manipulation techniques, as well as the role of the ECoW will be detailed within the outline CEMP (Appendix A2) and Method Statements.

7.10 Embedded Design

7.10.1 Where possible, the proposed development has been designed to avoid or reduce the magnitude of the potential impacts and risks. These ecologically driven designs are embedded into the proposed development and have therefore been taken account of during the assessment. The embedded designs to avoid or reduce such operational impacts to the ecological resource of the site are described in the subsequent sections.

7.10.2 The potential impacts identified during the operation of the proposed development were habitat loss and severance, species mortality and species disturbance, described in Section 17.8.

7.10.3 For the purposes of this chapter, the embedded designs comprises the following; development areas (i.e. station and allocated building plots, and associated car parks and access roads), drainage (including Flood Compensation Area (FCA), attenuation, drainage and newly created reens), structures (reens crossings and wildlife crossings), principles of ecological sensitive lighting, and all of the ecological habitat creation proposed within the Biodiversity Strategy (Figure 7.4). During detailed design the configuration of the Biodiversity Strategy may change to accommodate unknown environmental and design considerations (beyond the requirements and calculations of this OPA), however the quantum of the ecological designs and mitigations as described within this chapter will be upheld and secured through planning conditions.

7.10.4 Table 7.11 compares the loss of habitat as a result of the proposed development against the habitats to be created during construction (predominantly within ‘Phase 0’ of the Construction Phasing – see Chapter 3 and Figure 3.7 for more details). This table indicates the approximate ratio of net gains and net losses where appropriate. Whilst there will be a loss of some habitats, the habitats being created will generally be of higher quality than those being lost, in terms of species-richness and diversity once they reach maturity.

7.10.5 Net losses are described in relevant sections below but include those of pastoral and arable farmland, used by some populations of wildlife, particularly birds. The proposed habitat creation and enhancement will provide foraging and breeding opportunities for these populations, while the wider area still provides ample agricultural habitats to support these populations. The amount of agricultural loss is considered minimal in terms of ecological benefits for wildlife and is further assessed within the Socio-economic assessment (Chapter 11).

Table 7.11: Habitat loss compared to proposed habitat planting (excluding buildings and hardstanding)

Phase 1 Habitat Type (Phase 1 Code)	Area / length within planning boundary[70]	Area / length to be retained	Area / length to be lost due to proposed development	Environmental Masterplan habitat type	Area / length proposed within Environmental Masterplan[71]	Net habitat gain (and lost;gained ratio and percentage change)
Semi-natural broadleaved woodland (A1.1.1) – dry	5.92 hectares	5.00 hectares	0.92 hectares	Dry woodland (hazel dominant)	1.80 hectares	0.88 hectares (1:1.95, 15% increase)
Semi-natural broadleaved woodland (A1.1.1) – wet	0.49 hectares	0 hectares	0.49 hectares	Wet woodland	0.80 hectares	0.31 hectares (1:1.62, 63% increase)
Individual / Feature trees[72]	142 trees	79 trees	63 trees	Individual trees	200 trees	137 (1:1.85, 85% increase)
Dense scrub (A2.1)	0.65 hectares	0.65 hectares	0 hectares	Scrub	0.40 hectares	0.40 hectares (N/A as none lost. 62% increase)
Semi-improved neutral grassland (B2.2)	16.91 hectares	3.52 hectares	13.39 hectares	Species-rich grassland	12.12 hectares (8.92 hectares dry and 3.2 hectares wet)	-1.27 hectares (1:0.91, 8% decrease)
Improved grassland (B4)	25.98 hectares	13.94 hectares	12.04 hectares	N/A – no replacement proposed	0 hectares	-12.04 hectares (N/A as none proposed, 47% decrease)
Marshy grassland (B5)	1.14 hectares	1.14 hectares	0 hectares	N/A – no replacement proposed	0 hectares	0 hectares (N/A as none lost or proposed)
Poor semi-improved grassland (B6)	17.49 hectares	14.02 hectares	3.47 hectares	N/A – no replacement proposed	0 hectares	-3.47 hectares (N/A as none proposed, 20% decrease)
Tall ruderal (C3.1)	0.04 hectares	0.04 hectares	0 hectares	N/A – no replacement proposed	0 hectares	0 hectares (N/A as none lost or proposed)
Standing water (G1) (polygon -Faendre reen)	0.71 hectares	0.71 hectares	0 hectares	N/A – no replacement proposed	0 hectares	0 hectares (N/A as none lost or proposed)
Standing water (G1) (line)	11654 metres	7221 metres	4433 metres, comprising: Reen (ephemeral / secondary) (2566.99 metres) Wet ditch (154.49 metres) Damp depression (516.94 metres) Dry ditch (1142.84 metres) Wet woodland (51.8 metres)	New secondary reens and ditches	3724 metres	1003 metres of reens and wet ditches (1:1.37[73], 37% increase)
Arable (J1.1)	11.59 hectares	1.56 hectares	10.03 hectares	N/A – no replacement proposed	0 hectares	-10.03 hectares (N/A as none proposed, 87% decrease))
Native species-rich intact hedge (J2.1.1) Native species-poor intact hedge (J2.1.2) Native species-poor defunct hedge (J2.2.2) Native species-poor hedge with trees (J2.3.2) Total	225 metres 1358 metres 394 metres 5342 metres 7319 metres	15 metres 1196 metres 233 metres 2301 metres 3745 metres	210 metres 162 metres 161 metres 3041 metres 3574 metres	Species-rich intact hedgerow	4200 metres	3991 metres (1:20.05, 1773% increase) of species-rich intact hedgerow 626 metres (1:1.18, 9% increase) of hedgerow overall

[70] Habitat areas and lengths have generally been calculated using data from the Extended Phase 1 Habitat survey (Appendix E2), with the exception of the number of broadleaved scattered trees within the planning boundary, which has been calculated using data from the Arboricultural Survey Report (Appendix E6), which is considered to be more accurate in this respect than the Extended Phase 1 Habitat survey.
[71] All areas are currently approximations and may be subject to slight change during the detailed design stage
[72] Individual trees are calculated from the Arboriculatural Report (Appendix E6). These are the numbers of individual trees outside of woodland areas. These trees are additional to the woodland already described.
[73] This net gain has been calculated considering the loss of ephemeral/secondary reens and wet ditches only. It is considered that the loss of linear damp depressions, dry ditches and wet woodland are not relevant to this calculation, and the loss of the features of higher biodiversity value, i.e. the damp depressions and the wet woodland will be mitigated for under different categories, i.e. the wet species-rich grassland and wet woodland respectively. These features have been included within this category only to ensure consistency with landscape and drainage elements.

7.10.6 The Biodiversity Strategy (Figure 7.4) will provide green and blue infrastructure which will help to deliver climate change resilience in this part of Cardiff, in terms of both wildlife connectivity and ecological quality and quantity to support the wildlife populations. This would be in line with Planning Policy Wales TAN 5, the Nature Recovery Plan (2015) and the Cardiff LDP and Green Infrastructure SPG by ensuring no net loss of biodiversity, the maintenance and enhancement of green infrastructure and biodiversity, and taking specific action for habitats and species.

Habitats

Trees and Hedgerows

7.10.7 Where possible, trees, woodlands and hedgerows have been retained. However, in total 0.92ha of dry woodland and 0.49ha of wet woodland (comprising 63 trees) and 3,574m of hedgerow will be removed for the proposed development. Embedded compensatory planting has been designed to provide a 1:1.95 ratio of dry woodland, a 1:1.62 ratio of wet woodland, and a 1:1.18 ratio of hedgerow planting over of woodland, trees, and hedgerow planting, and the woodlands have been designed to enhance the biodiversity services to the local wildlife, particularly dormice and bats.

7.10.8 The majority of hedgerows due to be removed were identified as being species-poor during the Phase 1 survey. All 4.2km of hedgerows to be planting within the proposed development will be species-rich hedgerow, comprising at least seven woody species per 30m in line with the Hedgerow Regulations requirements for ‘Important Hedgerows’, and reaching 3-5m wide at maturity (approximately 8 years). Indicative species for planting for hedgerows are provided in the DAS.

7.10.9 A single hedgerow being 225m in length located centrally within the site running east from Faendre Reen was identified as species-rich and dormouse presence was confirmed within over half of the nest tubes placed along this hedgerow. 15 metres of this hedgerow will be retained, whilst 210 metres of this hedgerow must be moved for the proposed development. As such, this 210m will be translocated, most likely at an angle to where it is currently located, forming a boundary between a development area and an area of soft landscaping. Such translocation will reduce the impacts associated with the loss of the species diversity within this hedgerow and of the habitat maturity in supporting dormice. A Hedgerow Translocation Method Statement will be provided with a final CEMP to avoid damage to the hedgerow during the works.

7.10.10 Chapter 3 Construction phasing outlines how most ecological design planting will be undertaken within ‘Phase 0’, to allow these habitats to better establish prior to any vegetation clearance, with some clearance not occurring until year five of new created habitat growth. This will reduce the impact of habitat loss during construction, as the majority of replacement habitat will be in place prior to any habitat removal. Further to this there will also be opportunities to translocate mature hedgerow, over and above the species-rich hedgerow mentioned above, as

part of the habitat creation from areas that will be identified most suitable by an arboriculturist pre-works. Translocating mature trees from hedgerows will provide a mature and functioning hedgerow habitat quicker than those that are planted with tree standards[74] and whips[75]. The species selected for translocation will prioritise those that provide food sources for dormice, being hazel, blackthorn, hawthorn, oak, sycamore, honeysuckle and bramble; further details are provided within the section above in Section 7.9 regarding assumed mitigation required under licence specifically for dormice.

7.10.11 The most significant of the woodland and hedgerow habitat creation is the 'Wildlife Corridor' running from the north west to the south east for approximately 800m underneath and either side of the pylons (north of the railway line), as shown on the Biodiversity Strategy (Figure 7.4). This will comprise a line of double hedgerows, enclosed by a swathe of wet woodland to the west, and scrub and hazel-dominated woodland to the east, totalling approximately 2,260m of species-rich hedgerows, 0.8ha of wet woodland and 1.2ha of deciduous woodland, with a high mix of hazel (as shown in Table 7.11 above). The Wildlife Corridor will be connected to the existing woodland habitat in the north east which is also connected to woodland edges down into Hendre Lake park.

7.10.12 Further hedgerow and tree planting is proposed within the Main Park east of Faendre Reen (as shown on the Biodiversity Strategy (Figure 7.4)), with hedgerow and woodland planting running south to the railway line to enhance the existing connective corridors. This will align with a new hedgerow to the south of the railway, to provide an improved connection across the railway where animals, including dormice, are likely to be crossing already (based on populations being present both sides). Dormice have been found to be crossing existing highways[76] and the current population distribution of dormice in this area suggests they are potentially crossing the railway line.

7.10.13 A hedgerow is also proposed within the 12.5m vegetated buffer of Ty Ffynon Reen which zig zags through the site from the east off Greenlane reen down to the railway line west of the proposed station, as shown on the Biodiversity Strategy (Figure 7.4). This has been designed and located to avoid excess shading of Ty Ffynon Reen to avoid degradation of aquatic macrophytes and optimise the habitat for aquatic invertebrates and water vole.

7.10.14 Further, woodland and hedgerow planting and / or translocation will occur south of the railway line, as shown on Figure 3.4. Species-rich hedgerow will be created within the south connecting into existing hedgerow habitats and away from both existing and created reens to avoid shading of the reens (see Drainage section below for further details on created reens). Woodland strips will also be created to

[74] A standard form tree has a single, straight trunk, absent of lower branches for a minimum of the first 1.8 metres.
[75] A whip is a slender, unbranched shoot or plant. This term is used in forestry to refer to unbranched young tree seedlings of approximately 0.5-1.0 m (1 ft 7 in-3 ft 3 in) in height and 2–3 years old, that have been grown for planting out.
[76] Dormouse were recorded by Chanin and Gubert (2012) crossing a gap of 12 metres at ground level between highway edge and central reservation on the A30 (8 metres of road and 4 metres of grass verge), and they have been recorded crossing a gap of approximately 25 metres at ground level across a minor road adjacent to the M42 during Arup's work on Smart Motorways.

enhance the habitat south of the railway line for dormice. This will include a connective woodland strip up to the railway line opposite enhanced woodland up to the railway line from the north (as described above). This will facilitate possible crossing of the railway line by dormice.

7.10.15 The Biodiversity Strategy (Figure 7.4) will deliver a net gain of more diverse and ecologically rich woodland and hedgerow habitats suitable to support a number of wildlife populations, with particular focus on dormice and foraging bats.

7.10.16 The monitoring and management of the woodland and hedgerows are detailed within Section 7.14 below.

Grassland

7.10.17 Marshfield SINC will be lost to the proposed development amounting to 4.98ha, along with a further 8.41ha of semi-improved grassland within the surrounding fields. The impact of the loss of the SINC and semi-improved grasslands will be reduced by the translocation of both turfs and soils from the SINC (as detailed below) and the creation of 10.2ha of species-rich grassland creation to the south of the railway, 1.92ha of species-rich grasslands within the Wildlife Corridor, totalling an area of 12.12ha of species-rich.

7.10.18 Selected turfs and soils will be translocated from the SINC into the fields south of the railway line, including the Flood Compensation Area (FCA). The turfs will be selected to translocate the rarer species found within the SINC, including, but not exclusively, corky-fruited water-dropwort, pepper saxifrage and stone parsley. These were all found within the drier areas of the SINC and as such the conditions being created within the south western species-rich grassland area will be better aligned for these species. The turfs will need be selected and marked and / or mapped during the flowering season prior to translocation and then cut to a depth of 200mm and then translocated during the autumn. The remaining soils within the SINC, to a depth of 100mm, will be translocated into the FCA for the creation of a wet species-rich grasslands.

7.10.19 Prior to translocation of the turfs and soils both receptor sites south of the railway line will need to be prepared. The ‘drier’ species-rich grassland area in the southwest will require a thin layer of the current top soil to be removed to remove

the high nutrient levels found within the topsoil. The turfs can then be laid, and a species-rich meadow mix seeded at the same time.

7.10.20 The FCA will be lowered, through removal of topsoil to a depth of approximately 0.5m, then the soils from the SINC spread over the site. A wet meadow species-rich grassland seed mix will also be sown over the FCA.

7.10.21 Both the drier' species-rich grassland area and the FCA will be profiled to re-create the historic landscape of a series of undulating levels with grip formation, which will provide conditions to support a mosaic of habitats within each field.

7.10.22 A Turfs and Soils Method Statement will be provided with a final CEMP to avoid damage to the turfs and seed bank within the soils during the works and provided the detailed design of the created habitats and landscape. A Soil Management Strategy is provided is provided in Appendix A3 also further details in the outline CEMP (Appendix A2)

7.10.23 The grasslands proposed south of the railway and within the Wildlife Corridor, as described in paragraph 7.10.11 above, will also have a mosaic of tall or tussocky grasslands and species-rich grasslands, which will be designed and managed to provide suitable habitat for the shrill carder-bee and the brown-banded carder-bee, both being Section 7 species and 'Nationally Rare' and 'Nationally Scarce', respectively. The shrill carder-bee is considered to be one of the rarest bumblebee, now known only from a handful of sites in south Wales and southern England and generally scarce even there. It has a strong association with complex flowers in the families *Lamiacaea* and *Fabacaea*. The shrill carder-bee is a long-tongued bumblebee and prefers plants with long tubular flowers. Favourite forage plants include white dead-nettle (*Lamium album*), hedge woundwort (*Stachys sylvatica*), black horehound (*Ballota nigra*) and legumes such as red clover, birds-foot trefoil and meadow vetchling (*Lathyrus pratensis*). Late flowering species include red bartsia (*Odontites vernus*), common knapweed and scabious. 'Weed' species such as ragwort and thistles can also be important forage resources. Red clover, however, is a favourite for the shrill carder-bee. It is vital forage resource with nutrient rich nectar and pollen which has a long flowering period.

7.10.24 The grasslands within both the Wildlife Corridor and those 'drier' species-rich grasslands being created south of the railway will ensure that plentiful flower rich forage habitat is available until late September. This will be achieved through management such as a cutting or grazing rotation. Management of the species-rich grasslands are detailed within Section 7.14 below.

7.10.25 The Biodiversity Strategy (Figure 7.4) will aim to deliver through translocations, seed mixes and subsequently management a more diverse and ecologically rich

grassland habitat in the south of the site, suitable to support a number of wildlife populations, with particular focus on the shrill carder-bee.

Reens and Drainage

7.10.26 The network of reens within the planning boundary comprise the main interest feature of the Gwent Levels – Rumney and Peterstone SSSI, part of which lies within the planning boundary. 4.43 km of the Gwent Levels – Rumney and Peterstone SSSI Secondary reen, ditches and field grip network will be lost within the proposed development. All Primary reens have been retained and will be enhanced where possible. As mentioned above, Greenlane Reen, does require widening by 3m wide for drainage and flood compensation, details provided above and in the Hydrology and flooding chapter (Chapter 5).

7.10.27 Of the reens being lost within the proposed development, only 2.57km were recorded as Secondary reens with an additional 154m as wet ditches (based on a combination of the 2017 to 2019 surveys: Phase 1 Habitat Surveys, great crested newt surveys, riparian mammal surveys and aquatic flora and invertebrate surveys). This aligns with 2.75km of the reens and ditches (within the proposed development area) being recorded as low or negligible suitability for water vole during the 2019 survey (see Table 14 in Section 7.11 below). Approximately 1.14km were recorded to be dry ditches during the combined surveys in 2017 to 2019, and a further 504m were recorded as field grips.

7.10.28 3.72km of new reens will be formed to replace the existing 2.72km wet reens lost as a result of the proposed development on a ‘like for like’ basis or improved, with a 3m wide base with 1 in 1 slopes and a 1m wide shelf just above water level on the south-facing side (or both sides space permitting) to ensure no reduction in the extent of the freshwater ecosystem. For water vole specifically, the reens will aim to be at least 80cm deep and 2m wide at water level, but this will likely depend on various factors, including the peening levels. Interconnectivity will be maintained as existing to ensure that the management of water levels is unaffected, as will connectivity with the Severn Estuary to maintain fish passage for sea-going migrants. The depths of the new reen will vary and dictated by the bed level of the existing reen network. Nevertheless, all will be created to be suitable for water vole, which will amount to providing a net gain of 1:1.7 of suitable water vole habitat (see Table 14 in Section 7.11 below). Within these created reens will be a 4m wide connecting reen, south of the railway, which will convey flows from Greenlane Reen into the flood FCA.

7.10.29 The replacement reens will be located within the species-rich grassland areas south of the railway line and will be created at an average distance of 30m apart, with the closest being approximately 22m apart. The reen banks will be undisturbed with a 1 to 2m edge of vegetation for water voles. The reens themselves will not be shaded by hedgerows or woodland planting, and as such would provide enhanced opportunities for growth of aquatic macrophytes compared to some of the reens which they would replace. This is considered

beneficial for all fish species as it provides refuge/cover and spawning opportunities for phytophilic (plant spawning) coarse fish species.

7.10.30 Where practicable and subject to NRW approval, vegetative and dredged material from existing Secondary reens to be lost, would be used to encourage colonisation of new reens and ditches by aquatic macrophytes. Only those reens with suitable quality and where aquatic macrophytes and any aquatic invertebrates of interest (particularly any associated with the SSSI designation) where recorded will be used for this translocation of dredged material. The benefits of translocating material to encourage colonisation in the newly created reens will need to be balanced with the biosecurity risk associated with spreading Schedule 9 INNS and determined in consultation with NRW.

7.10.31 Newly created reens will also be planted within key foraging species for water vole, such as grasses, rushes, sedges and horsetail. 227 plant species have been identified in water voles diet[33;34], and as such the planting schedules for the reens will be consistent with the local area and of species featured within the SSSI. Indicative species for planting along reed edges are provided in the DAS.

7.10.32 The monitoring and management of the reen habitats are detailed within Section 7.14 below.

7.10.33 As well as the 3.72 km of newly created reens, and as detailed above, a FCA of 3.2ha will be created south of the railway line. As described above, the FCA will be lowered, through removal of topsoil to a depth of approximately 0.5m, then the soils from the SINC spread over the site. A wet meadow species-rich grassland seed mix will also be sown over the FCA. The FCA will be profiled to re-create the historic landscape of a series of undulating levels with grip formation, which will provide conditions to support a mosaic of habitats within each field.

7.10.34 Sustainable Drainage Systems (SuDS) will be implemented across the site to manage rainfall using methods that mimic natural process, by using landscape and vegetation to control the flow, volume and quality of the surface water runoff; further details are provided in Hydrology and flooding chapter (Chapter 5). In addition to this, SuDS also provide amenity benefits by providing aesthetically pleasing and natural landscapes, and biodiversity benefits by creating habitats for wildlife and vegetated areas. An outline planting schedules for SuDS (including rain gardens and swales) are provided in the DAS.

7.10.35 The storm water drainage strategy and flood mitigation proposals have been designed to ensure no dewatering of existing reens and interconnectivity between reen network is maintained during operation of the proposed development. No

interconnectivity has been proposed between two Primary reens to ensure that there is no impact on the water management of the reen network.

7.10.36 The detailed design of all culverts and bridges would follow the CIRIA C786: culvert, screen and outfall manual[77], such that the structures do not pose an obstruction to fish migration through excessive flow velocity or raised bed height. This will facilitate the free passage of fish both within the reen network and to and from the Severn Estuary SAC and Ramsar site.

7.10.37 The two penstock or tilting weir penstocks that are proposed along Railway and Greenlane Reens are designed to operate as a 1 in 200-year flood defence and would only likely be shut for a period of 3-5 days at a time, to protect against a severe coastal flood event. The structures are therefore considered to be temporary barriers to fish migration when operated as designed, with a negligible effect on fish passage. Nevertheless, the structures will comply with the Eels (England and Wales) Regulations 2009, with eel passes installed as required.

Structures and Wildlife Crossings

7.10.38 Otter laying up sites where identified at Hendre Lake island, Faendre Reen, Ty Ffynon Reen; Green Lane Reen south of the railway and a reen coming off Greenlane Reen in the south of the site. Evidence suggests that otter are primarily using the Primary reens within the site. As such, road culverts over the Primary reens within the proposed development have been designed with otter ledges, to the DMRB specifications[78], as shown in Figure 7.4. For the purpose of structure and levels design the modelling used the 1 in 100 with 25% climate change flood levels for the highest water level to ensure the ledge should be sited at least 150 mm above the highest water level and allow for 600 mm headroom.

7.10.39 Otter fencing will be installed around the culverts designed for otter to encourage use of the culverts and discourage the otters crossing the roads.

7.10.40 The two culverts over Faendre Reen have also been designed to include a dormouse bridge structure[66] running in the top corners of the culverts, which will be connected to existing and created habitats, as shown in Figure 7.4. As discussed above this may require the use of dead hedging until any created habitat is established enough to function connectively. Culverts will be designed such that they do not pose a barrier to fish migration in line with best practice guidance.

7.10.41 A dormouse bridge is also proposed over the minor access road into the site through Hendre Park woodland off the roundabout of Cypress Drive and Sandbrook Road, as shown in Figure 7.4. This dormouse bridge will also function as a bat bridge to encourage bats up and over the road, as the minor road will be a maximum width of approximately 20m. This bridge is likely to be required to be

[77] Culvert, screen and outfall manual (C786). Benn J, Kitchen A, Kirby A, Fosbeary C, Faulkner D, Latham D, Hemsworth M (2019). CIRIA London. Report C786.
[78] The Highways Agency (2001) Design Manual for Roads and Bridges (DMRB) Volume 10 Section 4 Part 4 HA 81/99 Nature Conservation Advice in Relation to Otters

in situ during construction if this route is to be used as the main construction access route to site (see Chapter 3 and Figure 3.7 for further details).

Lighting

7.10.42 The principles of lighting strategy for the proposed development have incorporated considerations to the ecology of the site, and with reference to artificial lighting guidance for bats[2]. At this stage the lighting strategy is only indicative, and will be finalised during the detailed design stage, in collaboration with ecologists. Nevertheless, the key ecological principles to the lighting strategy are described below and will be secured through the RMA and planning conditions.

7.10.43 The key public spaces will require higher illumination for public safety and to promote activity. This lighting will be controlled to limit back spill, limit upward light and limit glare, nevertheless, these areas will still be bright and may impact foraging and commuting bats. As such, the lighting strategy proposes to minimise illumination in public areas that intersect the Primary reens and other ecologically sensitive habitats, such as in Hendre Lake Park where the minor access road and cycleway crosses the woodland area between Faendre Reen and Cypress Drive which was found to have the highest level of bat activity, as well as being used by dormice, otter and water vole. These frequent dark or low-light areas will aim to mitigate for the brighter areas, and where possible ensure no light spill over 0.5 Lux[62] on these ecologically sensitive adjacent habitats.

7.10.44 The main road into the proposed development off Cypress Drive will require lighting, however the lighting design will use directional lighting and be designed to ensure no light spill over 0.5 Lux at 1m from the road verge (this is due to inter-reflected light off the surface of the road is unavoidable).

7.10.45 Light spill will also be avoided into the Ty Ffynon Reen and it's 12.5m buffer (where possible) running through the proposed development to encourage otter, water vole and bat continues use. The road and footpath crossing Ty Ffynon Reen and Green Lane Reen will require lighting but directional lighting will be used and be designed to ensure no light spill over 0.5 Lux on to the reen.

7.10.46 Minimal low-level lighting will be permitted within the Wildlife Corridor. There are two footpaths crossing of the Wildlife Corridor to maintain the existing public footpath that crosses the proposed development and provide footpath connection between the station and the existing business park north of the sites. These footpaths will have minimal lighting which will be directional and ensure no light spill over 0.5 Lux on to surrounding habitat features.

7.10.47 Where possible, low-level lighting will be used to keep the illumination isolated and focussed and to limit light spill onto surrounding habitats. This may comprise lighting such as bollard lighting, handrail lighting, lighting integrated into furniture and floor marker lights. A number of methods may be utilised to limit obtrusive lighting, including control systems, optical controls, and position and

orientation. A control system may control the lighting, such as dimming via a lighting control system or control the brightness to the areas of public realm. Optical control comprises the careful specification of luminaires to control lighting distribution, for example, some column-mounted fittings have back spill optics to minimise the backward spread of light and control the forward throw of the light beam. The position and orientation of luminaires is critical to prevent unwanted light spill and glare. The design of this will be finalised in the detailed design stage.

7.10.48 The lighting itself should comprise a warm white LED light source. LED typically has no UV component and warmer colour temperatures with peak wavelengths greater than 550nm (3,000K) have a lower impact on bats[2].

7.10.49 No lighting is proposed in the areas south of the railway line.

7.11 Assessment of Effects

7.11.1 The assessment presented in this chapter takes into account the potential impacts to each ecological receptor and the assumed construction practices (Section 7.9) and embedded design measures (Section 7.10) to determine the significance of the effects.

7.11.2 The receptors within the study area are valued in accordance with the CIEEM (2018) guidance[13]. This geographic value assigned can then be used to determine the significance of the potential impacts of the proposed development. The values of the receptors are set out in Table 7.12.

Table 7.12: Evaluation of receptors

Receptor	Evaluation	Value
European Sites (SACs, SPAs and Ramsar sites)	European Sites are designated at an international level and are therefore of international value.	International
SSSIs	SSSIs are designated at a national level and are therefore of national value.	National
Wildlife Trust Reserve and SINCs	Wildlife Trust Reserves and SINCs are designated for their presence of habitats or species of local or regional importance by local authorities and are therefore of county value.	County
Habitats – reens	The reen system within the planning boundary is a designated feature of the Gwent Levels – Rumney and Peterstone SSSI and is therefore of national value.	National
Habitats – semi-improved neutral grassland and wet woodland	The botanical interest of the semi-neutral improved grassland was classified within the NVC survey as being of local value, although the areas that lie within the Marshfield SINC should continue to be regarded as being of county value. Wet woodland is a rare Section 7 Priority Habitat and a UK BAP Priority Habitat[79] and the area that lies immediately south of the railway is therefore of county value.	County and local
Habitats - hedgerows	The 15 Important hedgerows are of county value, whilst the remaining hedgerows are of local value.	County and local

[79] JNCC (2008) UK Biodiversity Action Plan Priority Habitat Descriptions - Wet Woodland

Receptor	Evaluation	Value
Habitats – modified habitats	The predominant habitats within the planning boundary are improved grassland and arable fields which are of low ecological value and are therefore considered to be of less than local value.	Less than Local
Habitats – other habitats	All other habitats including dry semi-natural broadleaved woodland, dense and scattered scrub, marshy grassland, poor semi-improved grassland and tall ruderal are fairly typical and therefore also considered to be of local value.	Local
Dormice	The habitats on site were found to support a dormouse population of a relatively high density (possibly near carrying capacity in places). Due to the connectivity of habitats present on site, it is assumed that dormice are present throughout suitable habitat. As such, the dormouse population within the planning boundary is considered to be of regional value.	Regional
Barbastelle bat	Barbastelle are an Annex II species but only three passes recorded during all of bat surveys. As such, Barbastelle bat population within the planning boundary is considered to be of county value.	County
Other bat species	Other bat species recorded are common and typical of these habitats and are therefore of local value.	Local
Otter	Otter numbers have been increasing steadily over the past few decades in this region[80]. No breeding sites where found within the planning boundary and surrounding habitats, although six laying up sites were recorded. As such, the otter population within the planning boundary is considered to be of local value.	Local
Water vole	Water voles are the fastest declining mammal in Wales[81]. Therefore, despite being recorded along only one waterbody within the planning boundary, the population is considered to be of county value.	County
Amphibians	Great crested newt are likely absent from within the planning boundary, whilst smooth newt, palmate newt, common toad and common frog were found to be present. The amphibian populations within the planning boundary are therefore of local value.	Local
Badger	Habitats within the planning boundary are considered suitable only for badger foraging and commuting due the water table and wet nature of the site, and few signs were recorded during the badger survey. The badger population is therefore of less than local value.	Less than Local
Breeding bird assemblage	All species recorded within the planning boundary are fairly common species to the local area and typical of habitats on site. As such, the breeding bird assemblage is of local value.	Local
Wintering bird assemblage	No species listed as qualifying features of the Severn Estuary SPA or Ramsar site were recorded. However, a number of species recorded contribute to the assemblage feature qualification of both the SPA and Ramsar site. A peak count of 659 target birds was recorded in February, representing 0.93% and 0.70% of the Ramsar and SPA population, respectively. As such, the wintering bird assemblage is of local value.	Local
Barn owl	At least one tree within the planning boundary is considered to be a breeding site for barn owl with a second tree being a roosting site and/or	Local

[80] Strachan, R (2015) Otter Survey of Wales 2009-10
[81] NRW Water Voles. https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/uk-protected-species/water-voles/?lang=en [Accessed 16/01/2020]

Receptor	Evaluation	Value
	a second breeding site. Barn owl are Schedule 1 species however they are relatively common within the Gwent Levels. As such, the barn owl population within the planning boundary is of local value.	
Reptile populations	Only low numbers of reptiles were recorded, comprising common species. The reptile population is therefore of less than local value.	Less than Local
European Eel	No species-specific surveys were carried out for European eel. However, an individual was recorded in Ty Ffynon Reen and the reens are known to support a large population of European eel[57]. As such, the European eel population within the planning boundary is considered to be of local value.	Local
Lamprey sp. ammocoetes	No species-specific surveys were carried out for lamprey. However, there is potential for the larval (ammocoete) life-stage of sea, river and brook lamprey to be supported by the reens. This is considered a precautionary assessment as the reen habitat within the study area is considered to be poorly connected to lamprey spawning grounds upstream. The potential juvenile lamprey sp, population within the planning boundary is considered to be of local value.	Local
Invertebrates (terrestrial and aquatic)	No legally protected or red data book species were found in either the terrestrial or aquatic invertebrate surveys. No qualifying species for the Gwent Levels – Rumney & Peterstone SSSI were found on the site. Two Section 7 species were recorded within the survey area: brown-banded carder-bee and cinnabar moth. The invertebrate population within the planning boundary is therefore of local value.	Local
Other Section 7 species	Although suitable habitat is present for other Section 7 species on site, the habitat available is not significant enough to support any significant populations of these species. As such the populations of other Section 7 species such as hedgehog, brown hare and polecat within the planning boundary is of less than local value.	Less than Local

Assessment of Effects from Construction

7.11.3 The likely effects of the proposed development construction are assessed against the receptors identified within the planning boundary in the following sections. The assessment in this section has been made with assumed construction practices and embedded design measures as described in previous sections, and in accordance with the value of the receptors set out in Table 7.12.

7.11.4 Only receptors valued local or above will be taken forward for detailed assessment. In circumstances where there are other factors influencing the value of the receptor are not covered by the guidance, then professional judgement has overruled the guidance.

Designated Sites

Statutory Designations

7.11.5 A Habitat Regulations Assessment (HRA) has been undertaken due to the presence of internationally designated sites located within 10km and bat SACs located within 30km of the proposed development, in accordance with the Habitats Regulations (see Appendix E21). Consistency of information and

avoidance of duplication will be ensured between the HRA process and within the ES.

7.11.6 There are four internationally important sites within 10km of the planning boundary and three SACs within 10-30km designated for Annex II bat species. These are Severn Estuary SAC, SPA and Ramsar site (1km south), River Usk SAC (6.6km north east), Mendip Limestone Grasslands SAC (21km south), North Somerset and Mendip Bats SAC (24.5km south east) and the Wye Valley and Forest of Dean Bat Sites SAC (26.3km north east).

7.11.7 There are three nationally designated SSSIs within 2 kilometres of the planning boundary. These are Gwent Levels – Rumney and Peterstone SSSI (lies within the site boundary), Severn Estuary SSSI (1km south) and Gwent Levels – St. Brides SSSI (1.2km east).

7.11.8 Potential effects from construction activities, such as from dust deposition, pollution events or sediment run-off, to designated sites which are within relative close proximity and/or are hydrologically connected to the construction footprint will be avoided and reduced through standard best-practice techniques and methods as described within Section 7.9 above and within the outline CEMP (Appendix A2).

7.11.9 All watercourses/reens within the planning boundary drain to the south, ultimately into the Severn Estuary SAC, SPA, Ramsar site and SSSI. The outline CEMP includes best practice measures for the storage of hazardous substances, the siting of higher risk activities (e.g. vehicle washdown areas) and the maintenance of plant. Following implementation of these practices, the magnitude of any accidental spillage or temporary physical modification as a consequence of the proposed development is likely to be negligible. Therefore, the indirect effects on the Severn Estuary SAC, SPA, Ramsar site and SSSI relating to dust deposition, pollution events or sediment run-off are considered to be of **negligible significance**.

7.11.10 All other designated sites lie upstream or are a sufficient enough distance away for dispersal effects to avoid any potential impact pathways; as such are all considered to be of **negligible significance**.

7.11.11 Juvenile lamprey species have the potential to be present within reens of the site and European eel are known to be present within the reen network[42] and were recorded in Ty Ffynon Reen in 2017. River and sea lamprey are qualifying species of the Severn Estuary SAC, and eel are qualifying species of the Severn Estuary Ramsar, and migratory fish are cited on the Severn Estuary SSSI. As described in Section 7.9 above, where instream works require dewatering, reens will be drained down under the supervision of an ECoW with a background in freshwater ecology and fisheries. Netting and/or electric fishing techniques would be used and fish (and amphibians) would likely be translocated to Primary reens (Feandre and Greenlane reens) located to the east, west and south of the proposed development,

but this would be agreed in advance with the local NRW fisheries/biodiversity officer. With these best practise construction methods in place and the re-provision of lost reens, the direct effects on the qualifying fish species of the Severn Estuary SAC, Ramsar and SSSI are considered to be of **negligible significance.**

7.11.12 Otter are a qualifying feature of the River Usk SAC (6.6km north east of the site). Otters can travel over large areas. Some are known to use 20 kilometres or more of river habitat[82]. As such, the otters recorded present within the site have the potential to be part of the SAC population. Potential effects, such as habitat loss and severance, species disturbance and morality/injury are avoided and/or reduced through the best practice measures as described in Section 7.9 to a level where the potential effects on the integrity of the River Usk SAC otter population would be of **negligible significance**.

7.11.13 The three bat SACs located within 10-30km of the planning boundary are designated for the presence of greater and/or lesser horseshoe bat. Neither of these species were recorded within the survey area during any bat survey, and this species is therefore presumed absent from the proposed development. As such, there is **no pathway of effect** between the proposed development and these bat SACs.

7.11.14 None of the qualifying bird species of the Severn Estuary SPA and Ramsar site where recorded within the site, and at peak count less than 1% of the assemblage populations where recorded. As such the potential impacts of habitat loss, damage and severance, and species disturbance and mortality on the qualifying and assemblage bird species of the Severn Estuary SPA and Ramsar site are considered in of **negligible significance**.

7.11.15 The Gwent Levels – Rumney and Peterstone SSSI is primarily designated for the network of reens present throughout the SSSI, including within the proposed development. With the exception of any temporary diversion or structures that will need to be introduced at reen crossing locations, the Primary reens will be retained throughout the development, namely Greenlane Reen, Faendre Reen, Ty-Ffynon, Railway Reen and Green Lane Branch. Greenlane Reen requires widening which seeks to minimise the impact on the water environment to provide greater storage and increase conveyance of flow.

7.11.16 The loss of 4.43 km of secondary reens and ditches, of which 2.57km were recorded as wet Secondary reens with an additional 154m as wet ditches (the remaining were recorded as dry or field grips), will be mitigated by reen re-provision of 3.72km of wet reens with 3m base and 1 in 1 slopes, as described above in Section 7.10. Nevertheless, all proposed modifications to the reen network will require in-channel working that has the potential to modify flow processes and sediment movement through bank failure, erosion, scouring and

[82] https://www.mammal.org.uk/species-hub/full-species-hub/discover-mammals/species-otter/

modification of geomorphological features (as further described in Section 7.8 above and in the Hydrology and flooding assessment (Chapter 5).

7.11.17 When considering measures described in the outline CEMP (Appendix A2) as assumed construction practices, the magnitude of hydromorphological impacts during construction is considered to be reduced. Standard practice mitigation measures and working practices incorporated into the outline CEMP will minimise risks to the hydromorphology and thus the ecology of the reens in the study area. Due to the quantity of watercourses/reens affected, it is possible there will be a temporary measurable change in attribute quality or vulnerability, but will not affect the integrity of the attribute itself (see Chapter 5 Hydrology and flooding for further details).

7.11.18 However, due to the phasing of the proposed development, re-provisioned reens will be created before the de-watering and loss of the reens occurs. The re-provisioned reens will be created to hold water, being 3m wide at their base with 1 in 1 slopes at the banks, and as such this could provide a net gain of reens suitable for qualifying features of the SSSI. Furthermore, where appropriate the banks and dredged material from reens with SSSI interest will be translocated to the re-provisioned reens.

7.11.19 These factors considered, the significance of effect on the SSSI during construction is considered to be of **moderate adverse significance**, reducing to **negligible** as the re-provisioned reens aquatic and marginal flora and invertebrate assemblage start to establish.

7.11.20 The potential impacts of NOx emissions and nitrogen deposition on the Gwent Levels – Rumney and Peterstone SSSI during the construction phase was measured to be negligible and not significant, as emissions from heavy goods vehicles and site equipment would be minimal and temporary, resulting in an effect of **negligible significance**. For further details please refer to Chapter 8 Air Quality.

7.11.21 The Gwent Levels – St. Brides SSSI will be less impacted by the proposed changes to reen networks within the site boundary, due to spatial separation from the site. As such, significance of effect on this SSSI during construction is considered to be of **negligible significance**.

Non-Statutory Designations

7.11.22 There are 13 non-statutory SINCs and one Wildlife Trust Reserve within 2 kilometres of the planning boundary. All non-statutory sites, with the exception of Marshfield SINC, are located outside of the planning boundary and with best practise construction methods incorporated (as detailed within the outline CEMP)

any effects are considered to be of **negligible significance**, with most having no potential impact pathways.

7.11.23 Marshfield SINC will be permanently lost and directly impacted due to lying within the construction footprint. However, the 2018 NVC survey assessed the majority of grassland within the SINC as having only a moderate botanical value in a local context (see Appendix E5).

7.11.24 A total number 10.2ha of species-rich grassland will be provided within the south of the railway line and a further 1.92ha of species-rich tussocky grassland will be created within the Wildlife Corridor, as shown on the Biodiversity Strategy (Figure 7.4), to mitigate the loss of 4.98ha of semi-improved grassland within the SINC, although the SINC's designation itself cannot be mitigated.

7.11.25 Due to the phased construction approach, this new grassland will be created prior to the removal of the existing semi-improved grassland, with both turfs and soils from the SINC being translocated into the created grasslands south of the railway line. As such, the effect of habitat loss on Marshfield SINC during construction is considered to be of **moderate adverse significance**, reducing to **minor adverse to negligible** as the grasslands start to establish (approximately 5-10 years).

Habitats – Reens

7.11.26 As described above for the assessment of the Gwent Levels – Rumney and Peterstone SSSI, 4.43km of secondary reens and ditches, of which 2.57km were recorded as wet secondary reens with an additional 154m as wet ditches (the remaining were recorded as dry or field grips), will be mitigated by reen re-provision of 3.72km of wet reens with a 3m wide base and 1 in 1 slopes at the banks, as described above in Section 7.10. All proposed modifications to the reen network will require in-channel working that has the potential to modify flow processes and sediment movement through bank failure, erosion, scouring and modification of geomorphological features (as further described in Section 7.8 above and in the Hydrology and Flooding assessment (Chapter 5).

7.11.27 Standard practice mitigation measures and working practices incorporated into the outline CEMP will minimise risks to the hydromorphology and habitats of the reens in the study area. Furthermore, due to the phasing of the proposed development, re-provisioned reens will be created before the de-watering and loss of the reens within the proposed development. The re-provisioned reens will be created to be suitable for both water voles and qualifying features of the SSSI. Furthermore, where appropriate the banks and dredged material from reens with SSSI intertest will be translocated to the re-provisioned reens.

7.11.28 As such, the significance of effect on the reen habitats during construction is considered to be of **moderate adverse significance** (in Year 1 post-creation), reducing to **minor adverse** (in Year 2) to **negligible** (in Year 3) as the re-

provisioned reens aquatic and marginal flora and invertebrate assemblage start to establish.

Habitats - Semi-improved neutral grassland

7.11.29 Areas of grassland loss due to the proposed development have been calculated using the mapping within the 2019 Extended Phase 1 Habitat Survey. Calculations of habitat loss, retention, and replacement are given in Table 7.11.

7.11.30 A total of 16.9 ha of local value semi-improved neutral grassland (including the 4.98ha of county value SINC grassland, as discussed above) will be lost due to the construction of the proposed development.

7.11.31 As described above, a total of 12.12ha of species-rich grassland will be created within the Wildlife Corridor and the grassland to the south of the railway line. This will be from a combination of turf and soils translocation from the SINC, and through new planting and seeding of nutrient treated soils (nutrient-rich topsoils will be removed). As such, the significance of effect on semi-improved neutral grassland (not relating to the SINC designation) during construction is considered to be of **minor adverse significance**, reducing to **negligible** as the created grasslands start to establish.

Habitats – Woodlands

7.11.32 Areas of habitat loss due to the proposed development have been calculated using a combination of the mapping within the 2019 Extended Phase 1 Habitat Update Survey Report (Appendix E2) and the Arboricultural Survey Report (Appendix E6). Calculations of habitat loss, retention, and replacement are given in **Table 7.11**.

7.11.33 Approximately 0.49ha of county value wet semi-natural broadleaved woodland, and 0.92ha of local value semi-natural broadleaved woodland will be permanently lost due to the proposed development.

7.11.34 Approximately 0.8ha of wet woodland and 1.8ha of broadleaved woodland (hazel dominant) will be created within the Wildlife Corridor and forming woodland corridors within the north and the south of the proposed development (as shown in the Biodiversity Strategy (Figure 7.4)). Due to the phasing of the proposed development, some woodland habitats will be planted prior to removal of the existing habitat. However, the effect of woodland loss during construction is considered to be of **moderate adverse significance**, reducing to **minor adverse** as the woodlands start to establish.

7.11.35 Other impacts on retained woodland habitats such as root damage to retained trees, pollution events, dust and sediment run-off will all be avoided or reduced

through techniques and methods detailed within the outline CEMP. As such, these effects are considered to be of **negligible significance**.

Habitats - Hedgerows

7.11.36 The approximate length of hedgerow loss was calculated using the hedgerow data from the 2019 Extended Phase 1 Habitat Survey (Appendix E2), the Arboricultural Survey (Appendix E6), and the proposed hedgerow planting in the Biodiversity Strategy (Figure 7.4).

7.11.37 Approximately 3,574m of hedgerow will be lost, and 3,745m of hedgerow will be retained during construction of the proposed development. Of that lost, only 210m was identified as species-rich hedgerow. This hedgerow will be translocated, most likely at an angle to where it is currently located, forming a boundary between a SuDS area and the Main Park. Such translocation will reduce the impacts associated with the loss of the species diversity within this hedgerow and of the habitat maturity in supporting dormice. As described in Section 7.9 above, further sections of hedgerows will be assessed for translocation to aid with maturity of the hedgerow habitat being created for dormice.

7.11.38 All other hedgerows to be lost were identified as species-poor. Replacement hedgerows will be planted as species-rich and double planted, comprising at least seven woody species per 30m and reaching 3-5m wide at maturity (approximately 8 years). The hedgerows have been designed around the proposed development, through the Wildlife Corridor, alongside Ty Ffynon reen through the proposed development and throughout the area south of the railway line to provide a connected network through and around the proposed development and connecting to the surrounding network of hedgerows and woodlands. Due to the indicative construction phasing (Chapter 3), the majority of replacement hedgerows will be planted prior to removal of existing hedgerows. However, they will still be in the early stages of growth and as such the effect of hedgerow loss during construction is considered to be of a **moderate adverse significance**, reducing to minor adverse as planting throughout the proposed development starts to establish, and hedgerows reach maturity (approximately 8 years).

7.11.39 Potential impacts on hedgerows being retained, such as through root damage, pollution events, dust, and sediment run-off, will all be avoided or reduced through techniques and methods detailed within the outline CEMP (Appendix A2). As such, these effects are considered to be of **negligible significance**.

Habitats – Other habitats

7.11.40 The only other local or above valued habitat to be lost during construction is 3.47 hectares of locally valued poor semi-improved grassland. This is considered to be of **negligible significance**.

7.11.41 Other impacts on other locally valued habitats such as pollution events, dust and sediment run-off will all be avoided or reduced through techniques and methods

detailed within the outline CEMP (Appendix A2). As such, these effects are considered to be of **negligible significance**.

Bats

7.11.42 No confirmed bat roosts were identified within the planning boundary. Pre-construction surveys will be carried out to identify whether any trees with bat roosting potential have become roosts in the time between the surveys and construction.

7.11.43 Construction will result in the loss, severance and fragmentation of foraging and commuting habitat, and the disturbance of foraging and commuting bats. The design of the proposed development has aimed to maintain important bat habitats (e.g. hedgerows, woodland and reens) where possible and provide new habitats and connectivity through the development to replace that which will be lost.

7.11.44 The loss of 3.57km of hedgerow, 1.41ha of woodland, and 4.43km of secondary reens, ditches and grips due to construction will be mitigated through the habitat creation, reinstatement and enhancement as described above and shown within the Biodiversity Strategy (Figure 7.4). Due to the indicative construction phasing (Chapter 3), the majority of mitigation habitats will be created and planted prior to removal of existing habitat. However, they will still be in the early stages of growth and as such the effect of habitat loss to foraging habitat for bats during construction is considered to be of a **moderate adverse significance**, reducing to **minor adverse** as planting throughout the proposed development starts to establish.

7.11.45 The effects of severance and fragmentation of commuting and foraging bat habitat can be mitigated through the provision of dead hedging, as described in Section 7.9 above. Commuting and foraging bats may be subject to disturbance effects including noise, vibration, movement of plant and personnel, and lighting. This will be avoided or reduced by sensitive timing of works, keeping works within the bat activity period to a minimum. Temporary construction lighting required within bat activity periods would be directional lighting and designed to ensure no light spill over 0.5 Lux on to any identified commuting and foraging areas.

7.11.46 However, the construction effects are still likely to result in some bats seeking alternative foraging resources, travel greater distances and thus expend more energy during construction, as such the temporary effects of habitat severance and

fragmentation of commuting and foraging bats are considered to be of **minor adverse significance.**

Dormice

7.11.47 The construction of the proposed development has the potential to impact dormouse through habitat loss, severance and fragmentation, habitat damage, disturbance, and species mortality during site clearance.

7.11.48 All suitable dormouse habitat to be cleared (i.e. 1.41ha of woodland and 3.57km of hedgerow) would be removed under a EPS development licence obtained from NRW, details of the mitigation methods to be implemented under such a licence would be determined in consultation with NRW. The requirements under licence are likely to include a dormouse mitigation strategy covering all phases of clearance works, with translocation of individuals off site within the phase 1 clearance area and displacement methods to safeguard and move dormice out of the remaining areas to be cleared.

7.11.49 The construction phasing of the proposed development has been designed and developed to consider the requirements of vegetation clearance of dormouse habitat. All created habitats for dormouse, including the creation of 2.6ha of woodland, 0.4ha of scrub and 4.2km of species-rich hedgerows (all providing connectivity to existing dormice habitats retained within the site and surrounding area), would be planted in 'Phase 0' of the phased design, which would allow for a minimum of 4 years of growth before dormouse are displaced into these habitats. New dormouse habitat would be created north of the railway line in the form of the 'Wildlife Corridor' and woodlands and hedgerows around the site, as well as in Hendre Lake park west of Feandre Reen. South of the railway line new dormouse habitat would be created through woodland strips and hedgerows connecting to the wider hedgerow network (as shown on the Biodiversity Strategy (Figure 7.4)).

7.11.50 The EPS licence for dormice will detail approximate population densities of existing and planted and/or translocated habitats to avoid carrying capacities being exceeded, with the latter being achieved through a combination of translocation and phased displacement.

7.11.51 Habitat connectivity for dormouse would need to be maintained during construction, this would be achieved through dead hedging and use of dormouse bridge structures, and exclusion zones from existing and retained dormouse habitat would be enforced. Further details of these construction mitigation strategies for dormouse would be detailed within the EPS licence for dormice.

7.11.52 Potential impacts on dormouse habitats being retained, such as damage through root damage, pollution events, dust and sediment run-off would all be avoided or

reduced through techniques and methods detailed within the outline CEMP (Appendix A2) and the EPS licence for dormice.

7.11.53 With all these factors considered for the protection and safeguarding of dormice (including a translocation and displacement strategy), which will be detailed and enforced through the EPS licence for dormice, the construction effects on dormice are considered to be of **minor adverse significance**, reducing to **negligible** as planting throughout the proposed development starts to establish.

Riparian Mammals

Otter

7.11.54 No otter breeding sites were identified during the 2019 field surveys, though five laying up sites were identified within the planning boundary. One lay-up site is located along a reen that would be removed as part of the proposed development (waterbody 23). The remaining four are located along reens that would be retained, although would be subjected to disturbances during construction. One potential otter couch was identified along a retained reen in 2017, although this site was re-visited in 2019 and the couch was no longer present.

7.11.55 As described within Section 7.9 above, an EPS development licence will be obtained from NRW for the loss of and disturbance of the otter resting places. A pre-construction survey will be carried out to determine the level of activity at potential breeding and resting sites, as detailed within the outline CEMP (Appendix A2); the assessment however is based on the current baseline.

7.11.56 The two reens that were assessed as having high suitability for otter will be retained and enhanced. Other reens, some of which will be lost, were assessed as having moderate, low, or negligible suitability, as shown in Table 7.13 below.

Table 7.13: Reen suitability for otters baseline and lost through the proposed development

Suitability for otter	Baseline length within planning boundary (m)	Length lost (m)
High	144	0
Moderate	3604	1452
Low	4852	829
Negligible	1088	799

7.11.57 The loss of reens and ditches, of which 2.57km were recorded as wet Secondary reens with an additional 154m as wet ditches (the remaining were recorded as dry or field grips), will be mitigated by reen re-provision of 3.72km of wet reens created south of the railway line with 3m base and 1 in 1 slopes, as described above in Section 7.10. The reens south of the railway line would be created during

Phase 0 of the construction phasing; others in the north would be widened and enhanced through the construction phasing.

7.11.58 The loss of other habitats suitable for otter (i.e. wet woodland and woodland alongside and/or near to watercourses) would be mitigated through the habitat creation, reinstatement and enhancement proposed within Biodiversity Strategy (Figure 7.4). 0.49ha of wet woodland and 0.92ha of woodland close to watercourses would be lost during construction, whilst 0.8ha of wet woodland and 1.8ha of woodland close to watercourses would be created. Some of this habitat would become available before the end of the construction period, but mostly would be in very early stages of growth during the construction period.

7.11.59 Further to this, under the EPS licence, if a breeding site is found during the pre-construction surveys, an artificial holt maybe required. The location of this would be agreed in consultation with NRW and detailed in the EPS licence and the final CEMP. As such, the construction effects of the habitat loss for otter is considered to be of **minor adverse significance**, reducing to **negligible** as the new habitats become available.

7.11.60 The effects of disturbance and potential for mortality during construction, however, are considered to be of greater significance to otter populations. Construction activities can cause temporary disturbance to otter, which are known to be highly susceptible to human disturbance, and can subsequently lead to effects such as abandonment of territory or of young. Temporal restrictions to working and exclusion zones, such as avoiding works in certain areas at certain times, and control of noise or light spill may be implemented and would be detailed within the EPS development licence the final CEMP. Night-time lighting will be designed to ensure no light spill over 0.5Lux onto identified otter habitats.

7.11.61 Severance during site clearance and construction can lead to the isolation of otter populations, which in worst-case scenarios could result in in-breeding and local extinctions, a reduction in territory or foraging habitat size, and / or complete isolation from vital resources such as foraging habitat. The negative effects of habitat severance and isolation would be mitigated by careful construction programming, the maintenance of safe crossing places for otters, and the installation of temporary and / or permanent fencing to funnel otters towards these crossing which will be detailed within the EPS development licence and the final CEMP. Nevertheless, there would be severance and disturbance effects during the construction of the road crossings over the Primary reens, particularly Feandre Reen where the laying up sites were recorded.

7.11.62 There is also the potential for riparian habitat to be damaged due to pollution run-off, dust or sedimentation during operation of construction vehicles or during the transportation of potentially polluting materials or substances. This pollution could negatively impact prey species, such as pollution intolerant salmonid fish, thus indirectly affecting otters by reducing foraging opportunities. This would be

avoided or reduced by the implementation of best practice construction techniques for pollution prevention and control, as detailed within the outline CEMP.

7.11.63 Otters may potentially become injured or trapped in excavations during construction. Any open excavations would therefore be covered at night or a means of escape provided, as detailed within the outline CEMP. Direct species injury or mortality may occur during construction of the proposed development, due to vehicle collisions or inadvertent damage to a holt (if present). Speed limits and work timings, which will be outlined in the EPS licence and the final CEMP, would be implemented to reduce the risk of collisions with construction vehicles.

7.11.64 With the construction mitigation considered, which would be required under the EPS licence, the disturbance effect on otters is considered to be **moderate adverse significance**, reducing to **minor adverse** once the crossings over, and works around, Primary reens are complete and exclusion zones established.

Water Vole

7.11.65 Potential water vole burrows were identified along Green Lane Reen and feeding stations along Ty Ffynon Reen, both of which will be retained but required road crossings. Pre-construction surveys would be undertaken to search for any new water vole burrows along reens that would be impacted by the proposed development, and whether any specific mitigation measures are required as described above. Such mitigation measures may include displacement by habitat manipulation or capture and translocation; these would be detailed within a water vole licence issued by NRW.

7.11.66 Severance during site clearance and construction, as described above for otter, can have negative effects on water vole, as can construction disturbances. A water vole licence would be agreed with NRW to safe guard water vole during construction as well as describing the displacement methods which would be used to move any population into safe areas during construction works.

7.11.67 As described for otter above, negative effects due to potential habitat damage due to pollution run-off, dust or sedimentation during construction, as well as potential species injury and mortality would be avoided or reduced by the implementation of best practice construction techniques for pollution prevention and control, and construction speed limits and work timings, as detailed within the outline CEMP (Appendix A2).

7.11.68 All of reens that were assessed as having high suitability for water vole are being retained within the proposed development. Other reens, some of which would be lost, were assessed as having moderate, low, or negligible suitability, as shown in Table 7.14 below.

Table 7.14: Reen suitability for water vole baseline and lost through the proposed development

Suitability for water vole	Baseline length within planning boundary (m)	Length lost (m)
High	1855	0

Suitability for water vole	Baseline length within planning boundary (m)	Length lost (m)
Moderate	1227	173
Low	4200	2283
Negligible	2266	464

7.11.69 The loss of reens and ditches, of which only which 2.72km were recorded as wet (the remaining were recorded as dry or field grips), would be mitigated by reen re-provision of 3.72km of wet reens with 3m base, 1 in 1 slopes and a 1m wide shelf just above water level on the south-facing side (or both sides space permitting); preferably at least 80cm deep and 2m wide at water level, but this would likely depend on peening levels. This would amount to providing a net gain of 1:1.7 of suitable water vole habitat, as described above in Section 7.10.

7.11.70 Due to the indicative construction phasing (Chapter 3), the replacement reens would be created and retained reens enhanced, prior to removal of existing reens. However, they may still be in the early stages of growth / development and as such the effect of habitat loss, severance and fragmentation, and disturbances during construction is considered to be of a **moderate adverse significance**, reducing to **minor adverse** as planting along reens throughout the proposed development starts to establish.

Amphibians

7.11.71 Due to the negative result during field surveys for great crested newt, and only one record of great crested newt within 2km, great crested newt are presumed absent from the planning boundary, and thus any no potential impact pathways are consider for great crested newt.

7.11.72 Other amphibians were recorded within the reen network, including smooth and palmate newts, common frog and Section 7 common toads. As such, where instream works are required, reens would be drained down slowly and under the supervision of an ECoW to allow any amphibians to be removed to suitable receptor locations outside of the construction footprint. This is further detailed within the outline CEMP (Appendix A2).

7.11.73 Amphibians would also be caught and moved to safety during the electric fishing techniques for fish species, as detailed in Section 7.9.

7.11.74 Pollution could negatively impact amphibian species. This would be avoided or reduced by the implementation of the pollution prevention measures as described in outline CEMP.

7.11.75 All other terrestrial habitat clearance would be conducted in a staged and sensitive manner to allow individuals to move out the area in to existing habitats (habitat manipulation, as detailed in the Reptile section below and within the outline CEMP or an ECoW would be present to remove any individuals to areas of safety. This would either be existing and/or created reens and/or habitats suitable to support amphibians, such as created stone and/or log pile hibernacula within the

Wildlife Corridor or the areas south of the railway line (as shown in the Biodiversity Strategy (Figure 7.4)).

7.11.76 These construction mitigations strategies considered the effects on local values amphibians is considered to be of **negligible significance**.

Badgers

7.11.77 No setts were identified within the planning boundary during the field surveys, and the area of the proposed development is considered suitable for commuting and foraging badger only. As such badger were valued as less than local within the context of the site; thus are not considered within this assessment of effects.

7.11.78 However due to badger setts being protected under legislation, a pre-construction survey for badger setts would be required within 3 months prior to any construction activities within the proposed development. If any setts are located a badger licence and associated mitigation may be required, by issue from NRW.

7.11.79 Construction mitigation for other protected species, such pollution preventions, night time lighting restrictions, covering of excavations, speed limits for vehicles, would also mitigate negative effects for commuting and foraging badgers.

Birds

Breeding Birds

7.11.80 During the construction phase, breeding birds are likely to be affected by disturbance and displacement associated with construction activities, and breeding habitat loss, primarily of arable / pastoral land and hedgerows. Nest destruction could also occur in the absence of mitigation measures.

7.11.81 Pollution control measures and timing of vegetation clearance to avoid impacts on nesting birds are detailed within the outline CEMP (Appendix A2). Furthermore, the embedded design provides new habitats that would be of use to breeding birds, although many of which will not be mature enough to provide breeding habitat for birds until the end of the construction period, as described within the construction phasing (Chapter 3).

7.11.82 With these measures in place, and considering the abundance of similar habitats locally, it is predicted that no significant impacts would occur on the populations of breeding birds within the planning boundary, and legal compliance with regard

to avoiding destruction of active nests can be achieved. As such, construction effects are assessed to be of **negligible significanc**e on breeding birds.

Wintering Birds

7.11.83 During the construction phase, wintering birds are likely to be affected by disturbance and displacement associated with construction activities and habitat loss, primarily of arable / pastoral land and hedgerows.

7.11.84 No species listed as qualifying features of the Severn Estuary SPA or Ramsar site were recorded. However, a number of species recorded contribute to the assemblage feature qualification of both the SPA and Ramsar site. A peak count of 659 assemblage feature birds was recorded in February, representing 0.93% and 0.70% of the Ramsar and SPA population, respectively. Based on the individual species, flock numbers and wintering bird assemblage present, the study area is assessed to be of local value for wintering bird populations.

7.11.85 As no particularly large or significant aggregations of birds were recorded and considering the partial habituation to disturbance in the area from existing disturbances from people (Hendre Lake and Park), housing, roads and rail, and the existing St Mellons business park, along with the abundance of similar habitats available for foraging and roosting to the south, east and west of the proposed development, no significant impacts on this feature of local value are predicted. As such, the construction effects are therefore assessed to be of **negligible significance** on wintering birds.

Barn Owl

7.11.86 As described above, barn owl sightings were frequently recorded during the bat surveys in 2019, including potential nesting and/or roosting locations in three oak trees within the site. As such, barn owl surveys by a licenced surveyor will be conducted during the breeding barn owl season prior to site work commencing to determine the presence of nests and roosts, and therefore whether specific mitigation measures are required.

7.11.87 Potential impacts on barn owls as a consequence of the proposed development include: habitat loss (including nesting and/or roosting sites and foraging habitat), disturbance, habitat severance, and direct species mortality (due to collision with construction vehicles).

7.11.88 Two of the trees identified as potential secondary nesting and/or roosting sites within the site would be lost during the construction phase (TN11 and TN13 on Figure 2 in Appendix E2, and T21 and T5 in Appendix E6**)**. The removal of any breeding and/or roosting sites would only be permitted after alternative provision has been provided, such as barn owl nesting boxes. Although the tree which was identified as the possible nesting site (due to two barn owls observed flying out of it) is being retained (TN12 on Figure 2 in Appendix E2 and T114 in Appendix E6), the disturbance during construction is likely to deter the pair from using this

tree during construction, and as such, alternative provisions would be required for this site as well before construction.

7.11.89 Habitat suitable for use by foraging barn owls would be lost in a phased approach over 4 years of the construction period. Barn owl foraging habitat would also be created and enhanced within the Wildlife Corridor and within the species-rich grassland being created south of the railway line, as detailed within Section 7.10. However, during construction there is likely to be a net loss of foraging habitat for barn owl, until the created and enhanced habitats have established.

7.11.90 Barn owl home ranges however, are large, consisting of approximately 350ha in the summer and 5,000ha in the winter[83]. The area within the planning boundary which would be lost permanently as potential foraging habitat is approximately 45 ha (excluded any created habitats within the Wildlife Corridor due to potential disturbance factors such as surrounding development and the pylons), which amounts to 13% of this pairs breeding territory. As such it is expected that the pair likely breeding within the proposed development would be able to continue to survive within the local area, and potentially within the southern area of the site, with the enhanced foraging and alternative nest sites provided. However, territory abandonment cannot be ruled out due to construction disturbances.

7.11.91 A temporary increase in general disturbance would occur during construction, which could adversely affect any breeding and/or roosting barn owls or their dependent young. Any disturbance activities within the vicinity of identified breeding sites and roosting sites would need to be sensitively timed with exclusion zones established, and controls of noise and light spill enforced.

7.11.92 Direct mortality due to collision with vehicles during construction is possible and could have a permanent impact on the conservation status of this species as it is considered particularly vulnerable to vehicle collisions due to its foraging method. During construction, site speed limits would be in place and work timings specified in the outline CEMP (Appendix A2), which would reduce risks of collisions.

7.11.93 With the inclusion of these potential effects and mitigation measures, the construction effect is considered to be of **minor adverse significance** for barn owl.

Reptiles

7.11.94 Vegetation clearance, ground works and site traffic in suitable reptile habitat have the potential to impact reptiles directly, through removal of habitat or accidental killing of individuals. Reptiles were recorded only at very low population densities and as such were valued at less than local; thus, are not considered within this assessment of effects. However, the killing or injuring of individual

[83] The Barn Owl Trust (2015) Barn Owl home range. https://www.barnowltrust.org.uk/barn-owl-facts/barn-owl-home-range/ [Accessed 27/01/2020]

reptiles could represent an offence under the WCA 1981 (as amended) and standard mitigation and best practice has therefore been proposed, see Section 7.9 above.

7.11.95 Habitat manipulation and creation strategies to displace any reptiles present have been detailed above and within the outline CEMP (Appendix A2). Reptile habitat to be retained would also be appropriately marked and fenced if required, and hibernacula and safe places created and identified for which any found individuals could be moved into during vegetation and site clearance. Due to the indicative construction phasing (Chapter 3), the majority of replacement reptile habitat would be planted prior to removal of existing habitat.

European Eel

7.11.96 The proposed development will result in the loss of 4.43km of secondary reens and ditches habitat (although only 2.72km were recorded to be wet) that is known to support a population of European eel. A number of retained reens may also be subject to alterations in water flow or level, resulting in disturbance to European eel during construction (see the Hydrology and flooding assessment, Chapter 5).

7.11.97 Habitat loss is considered to be temporary as it would be mitigated by of 3.72km of wet reens with 3m base and 1 in 1 slopes, all of which would be unshaded promoting in-stream macrophyte growth which would provide refuge habitat for European eel. Measures to mitigate for changes in water flow, water level and / or changes in water quality are set out in the Hydrology and flooding assessment, Chapter 5.

7.11.98 Direct mortality of European eel during construction would be avoided by undertaking a fish translocation prior to dewatering. Fish including European eel would be translocated under licence to suitable local habitat agreed with NRW fisheries/biodiversity officer.

7.11.99 Considering the mitigation methods provided, the construction effects on European eel are considered to be of **negligible significance**.

Lamprey sp. ammocoetes

7.11.100 Whilst there are no records of lamprey within the study area, the proposed development would result in the loss of .43km of secondary reens and ditches habitat (although only 2.72km were recorded to be wet) that has the potential to support the larval (ammocoete) life-stage of sea, river and brook lamprey. A number of retained reens may also be subject to alterations in water flow or level, resulting in disturbance to lamprey sp. (ammocoetes) during construction (see the hydrology chapter).

7.11.101 Habitat loss is considered to be temporary as it would be mitigated by of 3.72km of wet reens with 3m base and 1 in 1 slopes, which would contain suitable silty habitat for lamprey ammocoetes. Measures to mitigate for changes in water flow,

water level and / or changes in water quality are laid out in the Hydrology and flooding chapter (Chapter 5).

7.11.102 Direct mortality of lamprey species during construction would be avoided by undertaking a fish translocation prior to dewatering. Fish including lamprey species (if present) would be translocated under licence to suitable local habitat agreed with NRW fisheries/biodiversity officer.

7.11.103 Considering the mitigation methods provided, the construction effects on lamprey sp. (if present) are considered to be of **negligible significance**.

Invertebrates

Terrestrial Invertebrates

7.11.104 Potential impacts on terrestrial invertebrates as a consequence of the proposed development include; habitat loss, habitat severance, and direct mortality (during site clearance).

7.11.105 No legally protected or Red Data Book species were found, nor were any of the qualifying species for the Gwent Levels – Rumney & Peterstone SSSI were found on the site, including the shrill carder-bee and brown-banded carder-bee.

7.11.106 One Nationally Scarce species of terrestrial invertebrate was recorded within the tall, ruderal vegetation around Hendre Lake which will not be affected by the proposed development.

7.11.107 The most species-rich invertebrate site was the semi-improved grasslands to the north of the railway line, with a total of 100 terrestrial invertebrate species recorded, which corresponds to a greater number of flowering plant species in this habitat, compared to the other habitats. This grassland would be lost during the construction of the proposed development.

7.11.108 The species-rich grasslands being created within the Wildlife Corridor and the grasslands south of the railway line, which amounts to 12.12ha, would be designed, planted and managed to provide suitable habitat for the shrill carder-bee and the brown-banded carder-bee, both being Section 7 species and ‘Nationally Rare’ and ‘Nationally Scarce’, respectively, as described in Section 7.10 above.

7.11.109 Negative effects to invertebrate populations will be unavoidable but can be reduced by timing of habitat clearance and removal. However, as mentioned above no legally protected or Red Data Book species were found, and only one notable species was identified, being the Nationally Scarce black pollen beetle (*Meligethes fulvipes*) within tall ruderal vegetation around Hendre Lake which will not be impacted by the proposed development.

7.11.110 The effect of habitat loss and severance, and the unavoidable species mortality during site clearance and earthworks to invertebrate populations during

construction would therefore be of a **minor adverse significance**; reducing to **negligible** as planting throughout the proposed development starts to establish.

Aquatic Invertebrates

7.11.111 The proposed development will result in the loss of 4.43km of reens and ditches, of which 2.57km were recorded as wet Secondary reens with an additional 154m as wet ditches (the remaining were recorded as dry or field grips). Numbers and diversity of aquatic invertebrates were assessed as being moderate to high, although this was mostly confined to Faendre Reen and Greenlane Reen, and the other larger reens which cross the survey area internally. Many of the internal reens of the site were of much less interest, being extensively overgrown and / or dried-out during the summer months.

7.11.112 All Primary reens within the proposed development would be maintained and enhanced, although a number of crossings would be required, and Greenlane Reen requires widening by 3m. Where instream works are required, they would be drained down under the supervision of an ECoW. Where possible aquatic vegetation from drained waterbodies would be placed on the banks of retained and/or created reens for a minimum of 24 hours to allow invertebrates to move out of the vegetation.

7.11.113 Habitat loss of reens would be mitigated by the re-provision of 3.72km of new reens with a 3m wide base with 1 in 1 slopes to ensure no reduction in the extent of the freshwater ecosystem. Interconnectivity would be maintained as existing to ensure that the management of water levels is unaffected. The reens themselves would not be shaded by hedgerows or woodland planting, and as such would provide enhanced opportunities for growth of aquatic macrophytes and invertebrates compared to some of the reens which they would replace.

7.11.114 Measures to mitigate for changes in water flow, water level and/or changes in water quality are laid out in the Hydrology and flooding chapter and the outline CEMP (Appendix A2). However, direct species mortality of some aquatic invertebrates during construction is unavoidable and difficult to mitigate for. However, due to the apparent absence of any legally protected or Red Data Book aquatic invertebrate species, and the habitat creation through the re-provision of reens south of the railway line (amounting to a net gain of wet reens, at a ratio of 1:1.38), the effect of construction is considered to be **negligible significance** on the invertebrate assemblage.

Other Section 7 Species

7.11.115 Habitat suitable for Section 7 species (other than those discussed above), especially hedgehog, brown hare and polecat are present within the study area. During construction, potential impact could occur through permanent and temporary habitat loss, severance and disturbance, as well as individual mortality. However, embedded mitigation and best practise techniques, such as habitat clearance designed and timed to be sensitive to these species alongside using habitat manipulation clearance techniques to deter species away from areas, would

remove or minimise these risks. These approaches are detailed above for other protected species and within the outline CEMP (Appendix A2).

7.11.116 Habitat creation, most of which would be realised before the end of construction, would also provide alternative habitats for these species. Provisions would be made by the ECoWs for any animals found during construction which need to be moved. For example, the mitigation areas specifically for hedgehog would be provided adjacent to new or retained hedgerows. With the inclusion of these mitigation measures, it is predicted that no significant impacts would occur on these Section 7 populations during construction. Therefore, an effect of **negligible significance** is predicted.

Assessment of Effects from Operation

7.11.117 It should be noted that wildlife populations within the planning boundary already exist within a baseline environment immediately adjacent to the St Mellons business park, railway line, roads and housing. Hendre Park is frequently used by the general public for recreation and dog walking.

7.11.118 The assessment of effects from operation assumes that the planting within the created and enhanced habitats of the proposed development have fully established and are capable of supporting the existing species populations, minus any reductions in these due to translocation strategies, such as the dormice, which have been described and assessed above.

Designated Sites

Statutory Designations

7.11.119 The potential operational effects to the Severn SAC, SPA, Ramsar site and SSSI would arise as a result of being hydrologically connected to the proposed development drainage, and as such could be affected by fuel and chemical spills from roads and hard standing areas.

7.11.120 SuDS would be implemented across the site to manage rainfall using methods that mimic natural process, by using landscape and vegetation to control the flow, volume and quality of the surface water runoff. The storm water drainage strategy and flood mitigation proposals have been designed to ensure no dewatering of existing reens and interconnectivity between reen network is maintained.

7.11.121 No permanent barriers to SPA or Ramsar site fish species are proposed and the habitat loss to SPA and Ramsar site bird species is considered not to be significant, as described in the construction assessment above. As such, the operational effects on the Severn Estuary SAC, SPA, Ramsar site and SSSI is considered to be of **negligible significance**.

7.11.122 Otter ledges in the culverts crossing Feandre reen and otter fencing will reduce the potential impact of otter vehicle collisions by providing safe passage and

connected habitats. As such, the operational effects on the River Usk SAC is considered to be of **negligible significance**.

7.11.123 As described above, a total of 4.43km of reens, ditches and field grips would be lost from the Gwent Levels – Rumney and Peterstone SSSI, of which only 2.72km were recorded as wet (the remaining were recorded as dry or field grips). These would be mitigated by reen re-provision of 3.72km of wet reens with a 3m wide base and 1 in 1 slopes on the banks, during construction. This is considered to be a net gain of wet reens, at a ratio of 1:1.38. These wet reens would be created to meet the conditions required to support the aquatic invertebrate and macrophyte species that are features of the SSSI.

7.11.124 As above, the SuDS and storm drainage strategy and flood mitigation proposals have been designed to ensure surface run-off and any pollution events would not enter the reen network, no dewatering of existing reens would occur and interconnectivity between reen network would be maintained.

7.11.125 The NOx and nitrogen deposition from the change in vehicle emissions due to increased use of the site has been measured to be negligible and not significant. For further details please refer to Chapter 8 Air Quality.

7.11.126 As such, the operational effects on the Gwent Levels – Rumney and Peterstone SSSI are considered to be of **negligible significance**.

7.11.127 All other statutory designated sites lie upstream or are sufficiently distant from the proposed development site, dispersion of any air quality effects would avoid any potential impact pathways.

Non-Statutory Designations

7.11.128 As mentioned above, the creation of 12.12ha of species-rich grassland would mitigate the loss of the 4.98ha of semi-improved grassland within the Marshfield SINC, although the SINC's designation itself cannot be mitigated. The created grasslands, which would include translocated turfs and soils from the SINC, have the potential to provide a biodiversity net gain of higher valued habitats; however, the value of these habitats is dependent on the monitoring and management of the created grasslands which is described in Section 7.12. As such, the effects of loss of the SINC are considered to be of **negligible significance**.

7.11.129 All other non-statutory designated sites are a sufficient enough distance away for dispersal effects to avoid any potential impact pathways.

Habitats

7.11.130 As mentioned above in Section 7.10 and shown in Table 11, the habitats being created and enhanced exceeds those being lost with:

- 0.8ha of wet woodland (ratio 1:1.62 or 63% increase over the whole site),
- 1.8ha of woodland (hazel dominate) (ratio 1:1.95 or 15% increase),

- 12.12ha species-rich grasslands; 8.92ha being 'dry' and 3.2ha being wet in the FCA (ratio 1:0.91 or -8% reduction[84]),
- 4.2km of species-rich hedgerows (ratio 1:20.5 or 1773% increase of species-rich hedgerow; and 1:18 ratio of total length of hedgerow),
- 3.72km of wet reens (ratio 1:1.38 or 37% increase), and
- 0.4ha of scrub habitat within the Wildlife Corridor (62% increase with no loss).

7.11.131 This increase in higher value habitats is considered a net gain, however, the realised value of these habitats is dependent on the management of the habitats, which is described in Section 7.14, to ensure habitats are optimal for target species. As such, the operational effects of habitats are considered to be of **minor beneficial significance**.

Bats

7.11.132 Following the establishing of landscape planting designed to provide habitat connectivity within the site and to the surrounding habitats, enhanced foraging opportunities for bats (through the creation of the Wildlife Corridor and the areas south of the railway line), and the implementation of limitations on light spill to bat foraging and commuting habitats (as described in Section 17.10), the operational effects on bat are considered minimal.

7.11.133 However, the new access road into the proposed development from the north west cannot accommodate a bat crossing structure, due to the width of the road, levels of the road and public safety. Structures will be formed over Faendre Reen either in the form of a bridge or a series of box culverts to facilitate for the proposed access routes into the site. These will incorporate otter ledges and a dormouse structure. The ledges will be located 150mm above the 1 in 100 year flood level including 25% for climate change. The exact size of the structures will be designed at detailed design stage. Nevertheless, due to the width of the reen in these locations the area of passage through the structure/culvert is likely to be suitable for some bat species[85]. Based on evidence-based studies, the species present within the site, particularly Daubenton's, Natterer's and brown long-eared bats, are likely to use the culverts as they have been recorded using 1m by 1.4m culverts[86,87]; and, potentially pipistrelle species which have been shown to use culverts 3m by 2m (in height) for culverts as long as 50m in length[85,88]. Other species recorded using the reen and adjacent woodland area for foraging and/or

[84] Based on 13.39ha of semi-improved neutral grassland being lost.
[85] Transport Directorate, Welsh Assembly Government and Countryside Council for Wales (2003) Review of work carried out on the trunk road network in Wales for bats.
[86] Abbott, Butler, and Harrison (2012) When flyways meet highways – the relative permeability of different motorway crossing sites to functionally diverse bat species.
[87] Highways Agency (2011) A review of bat mitigation in relation to highway severance.
[88] Brinkmann R., Bach L., Biedermann M., Dietz M., Dense C., Fiedler W., Fuhrmann M., Kiefer A., Limpens H., Niermann I., Schorcht W., Rahmel U., Reiter G., Simon M., Steck C. & Zahn A. (2003). Schadensbegrenzung bei der Lebensraumzerschneidung durch Verkehrsprojekte – Kenntnisstand-Untersuchungsbedarf im Einzelfall-fachliche Standards zur Ausführung. Positionspapier der Arbeitsgemeinschaft Querungshilfen. (http://www.buero-brinkmann.de/downloads/Positionspapier_2003_4.pdf).

commuting are not as susceptible to road collision due to the height at which they generally fly and forage, being noctule and serotines[89].

7.11.134 A dormouse bridge is also proposed over the minor access road into the site through Hendre Park woodland off the roundabout of Cypress Drive and Sandbrook Road. This dormouse bridge would also function as a bat bridge to encourage bats up and over the road, as the minor road would be a maximum width of approximately 20m.

7.11.135 A third crossing of the Hendre Lake park is proposed for a cycle route, however with bat sensitive lighting incorporated this is not seen as a barrier for foraging and commuting bats.

7.11.136 As such, with these structures considered for bat crossings and the enhancement of key bat foraging habitats, (including a 63% increase of wet woodland, a 15% increase of woodland (hazel dominate), a 1773% increase of species-rich hedgerows, a 37% increase of wet reens, and increase in species diversity of species-rich grasslands (albeit it a 8% reduction in the area of grassland when considering existing semi-improved and poor semi-improved)), the operational effects on foraging and commuting bats is considered to be of **minor beneficial significance**.

7.11.137 This increase in higher valued habitats is considered a net gain, however, the realised value of these habitats is dependent on the monitoring and management of the habitats which is described in Section 7.14.

Dormice

7.11.138 As described above, the loss of dormouse habitat would be mitigated by the creation and enhancement of dormouse habitats across the proposed development, with a 63% increase of wet woodland, 15% increase of woodland (hazel dominate), 1773% increase of species-rich hedgerows (1:18 ratio of total length of hedgerow lost vs. gain), and 62% of scrub (see Table 11). This habitat is well connected to existing dormouse habitat and has been driven by wildlife requirements, included lighting restriction.

7.11.139 This increase in higher valued habitats is considered a net gain, however, the realised value of these habitats is dependent on the monitoring and management of the habitats which is described in Section 7.14.

7.11.140 As mentioned above, the existing dormouse population is thought to be at carrying capacity and at its southern range. The habitat enhancements, both in quantity and quality, should ensure that the remaining dormouse population after translocation would have a sufficient habitat not just for survival but for population growth.

7.11.141 As described above for bats, the existing dormouse habitat between Cypress Drive and Faendre Reen would be severed in three places due to new access routes:

[89] Berthinussen and Altringham (2012) Do bat gantries and underpasses help bats cross roads safely?

firstly, the new main access road into the development from the north west; secondly, the new minor road from the west; and thirdly, the new cycle route from the west. Dormouse bridge structures would be incorporated into the two culverts that would cross under the new main access road, and a dormouse bridge would be provided over the new minor road. These crossing structures would be designed to connect into adjacent existing and planted habitats. The lighting design would ensure limited light spill onto these habitats (not exceeding 0.5Lux), in order to maximise the suitability of these crossings for dormouse. The third access route is required for a cycle path, however, with light spill (not exceeding 0.5Lux) onto surrounding habitats being limited, this route is not considered to present a barrier to dormouse movements.

7.11.142 Similar, there are two footpaths proposed through the Wildlife Corridor, both of which would be minimally lit to ensure no light spill over 0.5Lux on to the surrounding habitats. The area south of the railway line, where hedgerows and woodland strips are proposed, would not be lit.

7.11.143 In conclusion, with sufficient habitat connectivity provisioned throughout the proposed development for dormouse which is also habitat gain (both in quality and quantity), the operational effect for the reduced dormouse population (post-translocation), is considered to be of **moderate beneficial significance**.

Riparian Mammals

Otter

7.11.144 The habitat would be enhanced overall for otter with 0.8ha of wet woodland (62% increase) and 3.72km of wet reens (37% increase). Safe crossing locations where roads intersect Primary Reens would ensure the continued safe habitat use and connectivity throughout the site for otter, particularly Feandre Reen and Greenlane Reen where potential laying up sites were recorded. Culverts have been designed for otter modelled on the 100 year flood level with 25% climate change increase, details are provided in Section 7.10 above, and light spill would be avoided or minimised to less than 0.5Lux on to Primary reens.

7.11.145 SuDs will be provided to capture and treat surface water run-off from the roads and would act as holding tanks in the event of severe flooding or a major spillage from a collision.

7.11.146 Primary reens would have vegetated buffers of 12.5m either side to reduce disturbance effects to otters, and the area south of the railway line would provide an increased commuting and foraging area for otter, with the increase in quantity and quality wet reens. The size of the terrestrial habitat potential used by otter would be reduced, however as explained above this has been mitigated through the creation and enhancement of habitats suitable for otter away from the developed area. This increase in higher valued habitats is considered a net gain,

however, the realised value of these habitats is dependent on the monitoring and management of the habitats which is described in Section 7.14.

7.11.147 These factors considered the operational effects on otter are considered to be of **negligible significance**.

Water Vole

7.11.148 Water vole habitat within the site would be enhanced and provide a net gain of suitable habitats for water vole within the site, with 3.72km of wet reens (37% increase) being created to water vole preferred habitat, being 3m wide at the base, 1 in 1 slopes with a 1m wide shelf just above water level on the south-facing side (or both sides if space permits). All created reens would be planted with species favoured by foraging water vole and/or naturalised by moving existing reen vegetation and macrophytes to the bank sides of the created reens.

7.11.149 The reens being created south of the railway line would be surrounded by 12.12ha species-rich grasslands; 8.92ha being 'dry' and 3.2ha being wet in the FCA which would provide further food sources for water vole.

7.11.150 This increase in both quantity and quality water vole habitats is considered a net gain, however, the realised value of these habitats is dependent on the monitoring and management of the habitats which is described in Section 7.14.

7.11.151 As described above, Primary reens would have vegetated buffers of 12.5m either side and light spill on to reens and their bank side vegetation would be minimised to reduce disturbance effects to water vole and encourage continued use of retained reens adjacent to developed areas. Nevertheless, there would be an increase in disturbance level to Ty Ffynon Reen and Greenlane Reen particularly due to their proximity to the proposed development; both have had water vole activity previously recorded. The area south of the railway line for water voles would not be lit.

7.11.152 None of the structures proposed for the proposed development are considered to present any barriers to water vole. Drainage culverts would be provided to maintain hydro-connectivity, vegetated attenuation ponds would be provided to capture and treat surface water run-off from the roads and would act as holding tanks in the event of severe flooding or a major spillage from a collision.

7.11.153 As such, the operational effects on water vole are considered to be of **minor beneficial significance**.

Amphibians

7.11.154 As described above, great crested newts are presumed absent from the proposed development site. Impacts to other amphibian species are similar to those described above for water vole, in terms of enhanced quality and quantity of wet habitats, as well as terrestrial habitats in the form of hedgerows and woodlands.

As such, the operational effects on amphibians are considered to be of **minor beneficial significance.**

Birds

Breeding Birds

7.11.155 The potential breeding habitat for the bird assemblage recorded within the proposed development site would be enhanced though increased quality and quantity of hedgerows and woodlands (see amounts above and in Table 11), as well as marginal reen habitat, in particular common reed, which would have more opportunity to grow and spread within the increased availability of wet reens which would also provide breeding habitat for Cetti's warbler and reed bunting.

7.11.156 Planting has been designed at a distance from developed areas so as not to cause significant impacts on breeding birds. As such, the operational effects are considered to be of **minor beneficial significance** for breeding birds.

Wintering Birds

7.11.157 The total area suitable for wintering birds would be reduced, and some of the habitats which provide suitable foraging for the wading birds associated with the Severn Esturary SPA and Ramar site would be lost. The fields however to the south of the railway line would be enhanced to wet grassland fields which are able to support a rich diversity of invertebrates and are crucial for supplementary foraging for many wading bird species.

7.11.158 However, no species listed as qualifying features of the Severn Estuary SPA or Ramsar site were recorded, and only a low number of species that contribute to the assemblage feature qualification of both the SPA and Ramsar site were recorded, with a peak count representing 0.93% and 0.70% of the Ramsar and SPA assemblage population, respectively.

7.11.159 As such, the operational effects are considered to be of **negligible significance** for wintering birds.

Barn Owl

7.11.160 As described above in the construction effects for barn owl, although potentially only 13% of the breeding pairs territory would be lost, the size of the home ranges of barn owl means that should the pair be breeding within the proposed development site, they should be able to continue to use the remaining and enhanced habitats for both foraging and breeding. As described in Section 7.9, up to three barn owl nesting boxes would be provided (likely to be three if all three potential nesting and/or roosting sites are confirmed during pre-construction surveys) in the area south of the railway line, where the habitats would be enhanced for foraging barn owl through creation of wet reens, marginal habitats and tussocky species-rich grasslands, which would promote bank vole, field vole and water vole populations, all of which barn owl feed on. However, this increase

in both quantity and quality barn owl foraging habitat is dependent on the monitoring and management of the habitats which is described in Section 7.14.

7.11.161 These factors considered, the operational effects are considered to be of **negligible significance** for barn owls.

European Eel

7.11.162 As described within the construction assessment section above, loss of reens would be mitigated by reen re-provision which would amount to 3.72km of wet reens (37% increase), all of which would be unshaded and suitable for European eel.

7.11.163 Drainage culverts would be provided to maintain hydro-connectivity, vegetated attenuation ponds would be provided to capture and treat surface water run-off from the roads and would act as holding tanks in the event of severe flooding or a major spillage from a collision.

7.11.164 These measures and others designed to mitigate for potential impacts on the water environment are detailed in the Hydrology and flooding chapter (Chapter 5).

7.11.165 There are no permanent structures proposed, the two penstock or tilting weir penstocks that are proposed along Railway and Greenlane Reens are designed to operate as a 1 in 200-year flood defence and would only likely be shut for a period of 3-5 days at a time, to protect against a severe coastal flood event. The structures are therefore considered to be temporary barriers to fish migration when operated as designed, with a negligible effect on fish passage. Nevertheless, the structures will comply with the Eels (England and Wales) Regulations 2009, with eel passes installed as required.

7.11.166 With the inclusion of these mitigation measures, it is considered that any operational effects on European eel are of **negligible significance**.

Lamprey sp. ammocoetes

7.11.167 As described above, loss of reens would be mitigated by reen re-provision resulting in a 37% increase in wet reens, all of which would be unshaded and suitable for lamprey sp. ammocoetes.

7.11.168 Drainage culverts would be provided to maintain hydro-connectivity. Vegetated attenuation ponds would be provided to capture and treat surface water run-off

from the roads and would act as holding tanks in the event of severe flooding or a major spillage from a collision.

7.11.169 These measures and others designed to mitigate for potential impacts on the water environment are detailed in the Hydrology and Flooding chapter (Chapter 5).

7.11.170 With the inclusion of these mitigation measures, it is considered that any operational effects on juvenile lamprey sp. are of **negligible significance**.

Invertebrates

Terrestrial Invertebrates

7.11.171 The habitat creation and enhancement of the proposed development is considered to provide an increase in quality of species-rich grasslands (12.12ha) and both increase in quantity and quality of hedgerows and woodlands (increase of 63% of wet woodland, 15% of woodland (hazel dominant), and 1773% of species-rich hedgerows). These enhancements would provide an enhanced habitat for terrestrial invertebrates which should support an increase in abundance and diversity of invertebrate species.

7.11.172 The drier species-rich grasslands would be created and managed with species and function suitable for the shrill carder-bee, as detailed in Section 7.10 above.

7.11.173 This increase in higher valued habitats for terrestrial invertebrates is considered a net gain, however, the realised value of these habitats is dependent on the monitoring and management of the habitats which is described in Section 7.14. As such, the operational effects on terrestrial invertebrates are considered to be of **minor beneficial significance**.

Aquatic Invertebrates

7.11.174 As described above, aquatic invertebrate habitat would be enhanced overall with 3.72km of wet reens (37% increase), being 3m wide at the base, 1 in 1 slopes with a 1m wide shelf just above water level on the south-facing side (or both sides if space permits). All created reens would be planted and/or naturalised by moving existing reen vegetation and any invertebrates present to the bank sides of the created reens.

7.11.175 The reens being created south of the railway line would be surrounded by 12.12ha species-rich grasslands; 8.92ha being ‘dry’ and 3.2ha being wet in the FCA which would provide supporting habitats for some aquatic invertebrates.

7.11.176 This increase in both quantity and quality aquatic invertebrates habitats is considered a net gain, however, the realised value of these habitats is dependent

on the monitoring and management of the habitats which is described in Section 7.14.

7.11.177 As described above drainage culverts would be provided to maintain hydro-connectivity. Vegetated attenuation ponds would be provided to capture and treat surface water run-off from the roads and would act as holding tanks in the event of severe flooding or a major spillage from a collision.

7.11.178 As such, the operational effects on aquatic invertebrates are considered to be of **minor beneficial significance**.

Other Section 7 Species

7.11.179 Potential effects during operation on other Section 7 species, such as hedgehog, brown hare and polecat, include disturbance and permanent habitat loss. As described in the construction assessment above, the habitats being created and enhanced within the proposed development would be suitable for such species and generally provide a net gain over those habitats being lost (with the exception of semi-improved neutral grassland and lower value habitats, such as arable and pastoral farmland). Operational light spill onto important habitat areas would be avoided or minimised to less than 0.5Lux. However, overall, the operational effects on these Section 7 species are considered to be of **negligible significance** compared to the existing baseline.

7.12 Mitigation and Enhancement

7.12.1 Where it has not been possible to design the proposed development to avoid, eliminate, or reduce the magnitude of some of the potential impacts and risks identified in the previous assessment section, mitigation has been identified to achieve this. Mitigation measures seek to employ best-practice methods for dealing in particular with habitat loss, habitat severance, habitat damage, disturbance and species mortality. Enhancement measures have also been included, going above and beyond what is required to mitigate the adverse effects of the proposed development.

Construction Mitigation and Enhancement

7.12.2 Following the assessment of effects from construction in Section 17.11, no further construction mitigation has been identified or proposed, above what has already been detailed within the assumed best practise construction methods and licence requirements (see Section 7.9).

Operational Mitigation and Enhancement

7.12.3 The mitigation and enhancements proposed here would be secured through planning conditions on the OPA. Indicative locations, where appropriate, for

mitigations and enhancements proposed are shown in Figure 7.4 Biodiversity Strategy.

Bats

7.12.4 A range of bat boxes and/or bat bricks in buildings and bridges (no less than 20) will be provided on mature trees, and where possible buildings and bridge structures, within the proposed development. The number and location will be selected by the ECoW and would be informed by the number of appropriate trees, buildings and bridge structures within the proposed development.

7.12.5 The provision of bat boxes is considered to be enhancement, outside any requirements under licence.

Otter

7.12.6 An artificial holt will be provided on Feandre Reen, or an alternative site to be identified by the ECoW in consultation with NRW, to provide a suitable breeding site for otters. No breeding sites were recorded within the site, however a number of laying up sites where recorded, with the majority along Feandre Reen.

7.12.7 The provision of otter holts is considered to be enhancement, outside any requirements under licence.

Water vole

7.12.8 A Mink Control Programme will be written in agreement with NRW and carried out within the proposed development and in areas agreed with NRW and landowners.

7.12.9 A Mink Control Programme is considered to enhancement and over and above the normal mitigation requirement under licence or otherwise.

Birds

7.12.10 A range of bird boxes (no less than 20) will be provided on mature trees, and where possible buildings, within the proposed development. The number and location will be selected by the ECoW and will be informed by the number of

appropriate trees and buildings within the proposed development. Swift (*Apus apus*) boxes and house sparrow boxes should be prioritised for buildings.

7.12.11 The provision of bird boxes are considered to be best practise mitigation when relatively large areas of hedgerows and a number of mature trees are to be removed, in order to provide suitable alternative nesting locations.

7.12.12 Barn owl boxes will be provided and are described in Section 7.9 above.

7.13 Residual Effects

7.13.1 The residual effects reported here are the effects of the development, positive and negative, on the ecological receptors after taking account of mitigation and enhancement measures described above.

7.13.2 Therefore, only those ecological receptors that have had mitigation and enhancement described above are described below. All other ecological receptors effects remain the same as described within Section 17.11 and summarised in Table 20 at the end of the Chapter.

7.13.3 The Biodiversity Strategy (Figure 7.4) will provide green and blue infrastructure which will help to deliver climate change resilience in this part of Cardiff, in terms of both wildlife connectivity and ecological quality and quantity to support the wildlife populations. This would be in line with Planning Policy Wales TAN 5, the Nature Recovery Plan (2015) and the Cardiff LDP and Green Infrastructure SPG by ensuring no net loss of biodiversity, the maintenance and enhancement of green infrastructure and biodiversity, and taking specific action for habitats and species.

7.13.4 Cumulative effects are assessed and described for biodiversity with Chapter 16 Cumulative Effects Assessment, and as such are not repeated here. In combination effects are also considered in relation to the Habitat Regulations in the HRA (Appendix E21).

Residual Effects from Construction

7.13.5 All residual effects remain as detailed within Section 7.11 above.

Residual Effects from Operation

Bats

7.13.6 The provision of at least 20 bat boxes throughout the proposed development would enhance the bat roosting habitat within the site. As such, with all other bat

mitigation embedded into the proposed development, the residual effects are considered to be of **moderate beneficial significance**.

Otter

7.13.7 The provision of an artificial holt would provide a suitable breeding site for otters, which may be lacking due to lack of suitable areas, such as cavities in bank-sides made by waterside trees or rocks. As such, residual effects are considered to be of **moderate beneficial significance.**

Water vole

7.13.8 A Mink Control Programme has the potential to improve the water vole population within the proposed development and surrounding area by reducing the predation pressure, as such residual effects are considered to be of **moderate beneficial significance** for water vole.

Birds

7.13.9 The provision of at least 20 bird boxes would be provided as additional nesting habitat for bird species, including those which may not be present within the site currently. As such, residual effects are considered to be of **minor beneficial significance** for the breeding bird assemblage.

7.14 Monitoring and Management

7.14.1 A programme of monitoring and management will be undertaken for periods which are to be agreed with the Local Planning Authority. The subsequent sections set-out the general principles of the management and monitoring proposals for created habitats and other ecological receptors within the planning boundary. The full details of any management and monitoring plans would be developed and finalised in the Habitat Management Plan (HMP) to be prepared and likely secured through planning conditions.

7.14.2 For habitats, monitoring and management is most important during the early maturity and establishment period. For this reason, monitoring and management prescriptions for the first five years are extensive, thereafter periods between monitoring are extended to Year 10 and Year 15, and management and maintenance of the habitats is also generally reduced. However, certain habitats,

such as species-rich grassland would require continued specific meadow management to maintain desired swards and species diversity.

7.14.3 The majority of habitats would be created during the initial 'Phase 0' of the project, and as such, Year 5 of the proposal is likely to coincide with the last phases of construction.

7.14.4 The following tables set out the general activities and their frequencies for each general habitat type being created for ecological mitigation (this does not include all other landscaping, parks and SuDS proposed).

7.14.5 Monitoring of protected and key species, and any provisions for protected species are also defined below.

Habitats

Woody Habitats (Woodland, Hedgerows and Scrub)

7.14.6 The management of woody habitats would ensure that the continuity of arboreal cover is maintained, for example, any breaks in hedgerows would be replaced. New planting would be monitored until established. Table 7.15 to 7.16 below outlines the indicative monitoring and cyclic activities required to established proposed woody habitats; these would need to be agreed and secured through the HMP.

Table 7.15: Outline cyclical activities and frequency for the management and monitoring of woodland (NOTE: specific differences for wet woodland)

Ecological Habitat	Cyclical activities	Frequency
New woodland planting	Monitoring should be carried out using Common Standards Monitoring Guidance for Woodland Habitats[90] by a suitably qualified ecologist. Remedial actions based on monitoring may be required, these will be determined by the ecologist in consultation with NRW and/or Cardiff Council (if required).	Once at Year 3, 5, 10 & 15 (or as necessary if remedial actions required)
	Carry out regular walk over inspections in late summer. Carry out trimming, crown thinning or formative pruning to encourage healthy thriving growth. Control excessively invasive growth or replanting as necessary. Water as necessary to maintain healthy growth, particularly in times of low rainfall in summer (at least the first five years). Keep areas 750 mm in dia. around each new plant weed free, by herbicide treatment, strimming or hand pulling, until 100% canopy cover has been achieved. NOTE: Herbicide not to be used where there is the potential for contamination of any water body. Cut plants back where they overhang hard surface and grass areas excessively.	Annually
	Thin / coppice woodland, by tree removal, as necessary to reduce competition for space. Remove an even mix of species or remove species to restore a healthy balanced mix. Pile dead wood in habitat piles scattered throughout the woodland	Once at year 5 or as necessary thereafter

[90] JNCC (2004) Common Standards Monitoring Guidance for Woodland Habitats

Ecological Habitat	Cyclical activities	Frequency
	Remove spiral guards and tube shelters after 5 years or as necessary to ensure plants are not constricted	Once at year 5 or as necessary thereafter

Table 7.16: Outline cyclical activities and frequency for the management and monitoring of hedgerow and scrub habitats

Ecological Habitat	Cyclical activities	Frequency
New hedgerow and scrub planting	Monitoring should be carried out using Hedgerow Survey Handbook[91] to achieve a species-rich hedgerow under the Hedgerow Regulations by a suitably qualified ecologist. Remedial actions based on monitoring may be required, these will be determined by the ecologist in consultation with NRW and/or Cardiff Council (if required).	Once at Year 3, 5, 10 & 15 (or as necessary if remedial actions required)
	Carry out regular inspections of the planting. Ensure the hedgerow is kept weed free to guarantee a high success rate of establishment of the hedgerow plants. Weed control either by use of contact weed killer or by manual control.	Quarterly up to year 5
	Water as necessary to maintain healthy growth, particularly in times of low rainfall in summer.	At least the first three years. Ongoing as necessary through summer
	Yearly, assess stakes and guards, replace any missing or damaged. Remove guards if they are beginning to restrict the development of the plants. The hedgerow shall be trimmed in winter on a cycle as appropriate to manage its height and spread, encourage a thick bushy habit and benefit wildlife. Where possible, hedgerows should be allowed to grow tall and thick so that there are natural overhangs (these concentrate the invertebrates and also provide overhanging branches for the bats to rest on). Yearly, assess whether scrub requires cutting back to desired area if encroaching in to other habitats, such as species-rich grasslands and woodlands.	Annually in winter
	Remove any stakes or guards remaining on the hedgerow planting. The hedgerow shall be maintained at a height suitable to its function, biodiversity value and in keeping with the character of nearby hedges.	Once in year 5
	Protect new and repaired sections of hedgerows from livestock and deer damage with electric fencing. Maintain electric fencing in safe and good functional condition. Regularly (e.g. Monthly) inspect fencing for wear, malfunction etc. Instigate repair as necessary.	Monthly

Grasslands

7.14.7 The management of both the wet and dry species-rich grassland should follow a hay-meadow regime, with the removal of hay in July followed by low-density

[91] Defra (2007) Hedgerow Survey Handbook. 2nd ed.

grazing by cattle or horses in the summer and autumn. Grazing by sheep would result in a loss of diversity, as sheep tend to select all the herbs leaving taller grasses and rushes to dominate. Grazing in the winter is likely to lead to high levels of mud through excessive poaching.

7.14.8 Issues with highly competitive and unwanted species, such as broad-leaved dock, may arise in the first couple of years following creation, and remedial action should therefore be carried out (such as spot treatment by herbicide) until the grassland stabilises. No other enrichment of soil or application of herbicides/pesticides should take place.

7.14.9 Grass margins along reen edges should be left uncut (i.e. no hay removal), with grazing only. This will provide a year-round tussocky grass cover for shrill carder-bees, as well as water voles and grass snakes.

7.14.10 Occasional scrub control may be required if bramble, hawthorn or willow start to establish along the reens and ditches, but this may not be required within the initial five years post-habitat creation.

7.14.11 Where grazing is not possible (e.g. in the proposed species-rich grassland areas within the wildlife corridor), it may be possible to maintain some of the grassland diversity by annual mowing, with removal of a hay cut in the summer. Access to these grassland areas by the public (especially dog-walkers) should be limited, to avoid the hay being trampled prior to cutting.

7.14.12 Ideally, plants within the more urban grassland areas (e.g. the proposed parkland) should be allowed to flower and set seed prior to the first mowing. Cuttings from mowing should be removed to maintain low soil fertility levels.

7.14.13 Table 7.17 and Table 7.18 below outlines the indicative monitoring and cyclic activities required to established proposed species-rich grassland habitats in drier and wetter conditions; these would need to be agreed and secured through the HMP.

Table 7.17: Outline cyclical activities and frequency for the management and monitoring of 'dry' species-rich grasslands

Ecological Habitat	Cyclical activities	Frequency
New species-rich grassland sward	Monitoring should be carried out using Common Standards Monitoring Guidance for Lowland Grassland Habitats[92] by a suitably qualified ecologist. Remedial actions based on monitoring may be required, these will be determined by the ecologist in consultation with NRW and/or Cardiff Council (if required).	Once at Year 1, 2, 3, 5, 10 & 15 (or as necessary if remedial actions required)
	Cut or graze to suppress growth of weed species and encourage wildflower species.	Twice annually (unless advised by the ecologist)
	Mowing Grass to remain uncut until late July/August then cut to a height of 75-150mm and the arisings removed. A second cut	Twice annually (unless advised by the ecologist)

[92] JNCC (2004) Common Standards Monitoring Guidance for Lowland Grassland Habitats

Ecological Habitat	Cyclical activities	Frequency
	should be taken at the end of September. All arisings to be removed from the field.	
	Grazing Alternatively, the sward can be grazed during this period to achieve a similar effect. Manage grazing using temporary fencing to optimise the diversity of ground flora species resilience of the sward for the benefit of wildlife and future grazing. Manage timings and stocking rates to minimise poaching and erosion damage to the soil. Graze the area in drier periods, avoiding spring and winter or when the ground is waterlogged	Ongoing

Management for shrill carder-bee

7.14.14 Management proposals for 'drier' species-rich grasslands should also consider the following management suggestions for shrill carder-bee[93]:

- Encourage that plentiful flower-rich forage habitat is available until late September. This can be achieved through a cutting or grazing rotation
- Cut traditionally managed hay meadows after mid-July; if possible rotate a late cut to provide forage into September.
- Leave wide uncut strips at the edge of fields to provide late forage (rotate strip each year)
- Cease summer grazing, or, instead, adopt light rotational grazing throughout the year
- Rotate cutting of hedges, ditches and banks— ensures some areas are cut late
- Establish new wildflower grasslands or pollen and nectar margins
- Leave tussocky grass and scrubby areas for nesting, undisturbed between March and October
- Protect and manage brownfield habitats by rotational clearance of vegetation to maintain mosaic with open flowery areas

Table 7.18: Outline cyclical activities and frequency for the management and monitoring of wet species-rich grasslands (damp meadow)

Ecological Habitat	Cyclical activities	Frequency
New species-rich wet meadow Saward	Monitoring should be carried out using Common Standards Monitoring Guidance for Lowland Grassland Habitats by a suitably qualified ecologist. Remedial actions based on monitoring may be required, these will be determined by the ecologist in consultation with NRW and/or Cardiff Council (if required).	Once at Year 1, 2, 3, 5, 10 & 15 (or as necessary if remedial actions required)
	Cut or graze to suppress growth of weed species and encourage wildflower species.	Once annually (unless advised by the ecologist)
	Mowing Grass to remain uncut until late September or until all desirable flowers have gone over and shed their seed. Cut to a height of 75-150mm.All arisings to be removed from the field.	Once annually (unless advised by the ecologist)

[93] Bumblebee Conservation Trust. Shrill Carder Bee Factsheet

Ecological Habitat	Cyclical activities	Frequency
	Grazing Alternatively, the sward can be grazed during this period to achieve a similar effect. Manage Grazing using temporary fencing to optimise the diversity of ground flora species resilience of the sward for the benefit of wildlife and future grazing. Manage timings and stocking rates to minimise poaching and erosion damage to the soil. Graze the area in drier periods, avoiding spring and winter or when the ground is waterlogged	Ongoing

Reens

7.14.15 New reens are unlikely to need much management input during the initial five years post-creation, with the potential exception of removal of aquatic vegetation in late summer (although this is not likely to be required in the first two years). Any management input will be agreed with NRW and drawn up into the detailed HMP, but is likely to include:

- Management of reen edges to ensure water is not shaded;
- Alternate banks to be cut each year to leave cover for protected/notable species;
- Cuts should not be too severe, and should be carried out outside of the water vole breeding season (March to October); and
- Any coppicing of willows should be carried out outside of the bird nesting season (March to August).

7.14.16 Reen monitoring will also be agreed with NRW and will follow NRW guidelines, likely to comprise surveys of 20 metre sections that can be repeated annually in Year 2, 3, 5, 10 & 15 (although NRW may require different frequencies).

7.14.17 Reen monitoring will also inform the requirement for any removal of invasive species from watercourses; methods to be agreed with NRW.

7.14.18 Table 7.19 below outlines the indicative monitoring and cyclic activities required to established proposed reen habitats; these would need to be agreed and secured through the HMP.

Table 7.19: Outline cyclical activities and frequency for the management and monitoring of reens

Ecological Habitat	Cyclical activities	Frequency
Reens	Reen monitoring will be agreed with NRW and will follow NRW guidelines, likely to comprise surveys of 20 metre sections that can be repeated annually. Remedial actions, including the removal of invasive species from watercourses, based on monitoring may be required, these will be determined by the ecologist in consultation with NRW (if required).	Once in Year 2, 3, 5, 10 & 15 (although NRW may require different frequencies)
	Management of reen edges to ensure water is not shaded – alternate banks to be cut each year to leave cover for protected/notable species. Cuts should not be severe.	Annual on alternate banks, outside of water vole breeding season (March to October)

Ecological Habitat	Cyclical activities	Frequency
	Willow coppicing to ensure water is not shaded.	As required (advised by ecologist), outside of bird nesting season (March to August)

Species

7.14.19 It is anticipated that surveys for protected and key species and species assemblages will be undertaken in Years 2, 3, 5 and 10 'post habitat creation'. These surveys will monitor the establishment and distribution of species and of the new habitats. Surveys will be undertaken in accordance with the scheme to be submitted to the local planning authority to discharge relevant conditions and in accordance with the construction phasing, as described in Chapter 3). These surveys are anticipated to include:

- **Bat transect surveys**: designed to cover the habitat areas created and/or severed by the proposed development, including the mitigation habitats south of the railway line, western woodland between Cypress Drive and Feandre Reen and areas around Hendre Lake, along the Wildlife Corridor, and along Ty Ffynon reen. Exact transect routes will be specified in the HMP;
- **Otter and water vole surveys**: to cover retained and created reens (and as specified within EPS mitigation licence);
- **Dormice surveys**: to cover retained and created dormouse habitat (woodland, hedgerows and scrub). These will be fully detailed within the EPS mitigation licence, however, are likely to include:
  - Monthly checks of dormouse nest boxes over the survey season (April to November (inclusive)) within newly created dormouse habitats (woodland, hedgerows and scrub), to ensure the use by dormice;
  - Greater density of nest boxes/footprint tunnels on either side of dormouse crossings over Faendre reen; and
  - Supplementary feeding of nest boxes (as/if required).
- **Barn owl**: to cover retained and created barn owl habitat (woodland, trees and grassland);
- **Breeding bird and wintering bird transects**: designed to cover the created habitat suitable for breeding or wintering birds. For wintering birds this could be restricted to the area south of the railway line; and for breeding birds the area south of the railway line, western woodland between Cypress Drive and Feandre Reen and areas around Hendre Lake, along the Wildlife Corridor,

and along Ty Ffynon reen. Exact transect routes will be specified in the HMP; and

- **Terrestrial and aquatic invertebrate surveys**: to cover retained and created invertebrate habitats (reens and grassland), with specific survey methods for the shrill carder bee.

7.14.20 Additional monitoring and any required maintenance in Year 2, 3, 5 and 10 will also be required for provisions provided for protected species including:

- Bat boxes,
- Bird boxes,
- Barn owl boxes, and
- The otter holt.

7.15 Assessment Summary Matrix

Table 7.20: Summary of assessment of residual construction effects for ecological receptors of local and above value and/or legal protection

Ecological receptor	Potential impact	Embedded design, assumed construction practices and mitigation	Value of receptor	Residual significance of effect during construction
		Designated Sites		
Severn Estuary SAC, SPA, Ramsar site	Indirect effects on the Severn Estuary SAC, SPA and Ramsar site and habitats which support the feature species relating to dust deposition, pollution events or sediment run-off.	Standard construction measures to reduce hydromorphological impacts of in-stream works as described within the outline CEMP (Appendix A2).	International	Negligible significance.
River Usk SAC	Habitat loss and severance, species disturbance and morality/injury to otter population potential linked to the SAC.	Standard construction measures to reduce hydromorphological impacts of in-stream works as described within the outline CEMP (Appendix A2). Temporal restrictions to working and exclusion zones, such as avoiding works in certain areas at certain times, and control of noise or light spill may be implemented, which will be detailed within the EPS development licence the final CEMP. Night-time lighting will be designed to ensure no light spill over 0.5Lux onto identified otter habitats. The negative effects of habitat severance and isolation will be mitigated by careful construction programming, the maintenance of safe crossing places for otters, and the installation of temporary and / or permanent fencing to funnel otters towards these crossing which will be detailed within the EPS development licence and the final CEMP. Enhancement could be sought through the provision of artificial holts away from construction areas.	International	Negligible significance.
Bat SACs	Located within 10-30km of the planning boundary are designated for the presence of greater and/or lesser horseshoe bat. Neither of these species were recorded within the survey area during any bat survey.	N/A	International	No pathway of effect.
Gwent Levels – Rumney and Peterstone SSSI	Loss of 4.43km of the reen network (2.57km secondary / ephemeral reens and 154m of which were wet ditches).	Reen re-provision of 3.72km of wet reens with 3m base and 1 in 1 slopes. Standard construction measures to reduce hydromorphological impacts of in-stream works as described within the outline CEMP (Appendix A2).	National	Moderate adverse significance, reducing to negligible as the re-provisioned reens aquatic and marginal flora and invertebrate assemblage start to establish.
All other SSSIs	All other designated sites lie upstream or are a sufficient enough distance	N/A	National	Negligible significance.

Ecological receptor	Potential impact	Embedded design, assumed construction practices and mitigation	Value of receptor	Residual significance of effect during construction
	away for dispersal effects to avoid any potential impact pathways.			
Marshfield SINC	Loss of 4.98ha of semi-improved neutral grassland within the SINC.	12.12ha of species-rich grassland provided across the proposed development, mostly provided prior to loss of SINC grassland due to phasing strategy. Soils and turfs from the SINC will be translocated into the species-rich grasslands to be created south of the railway.	County	Moderate adverse significance, reducing to minor adverse to negligible as the grasslands start to establish.
		Habitats		
Reens	Loss of 4.43km of the reen network (2.57km were secondary / ephemeral reens and 154m of which were wet ditches).	Creation of 3.72km of wet reens with 3m base and 1 in 1 slopes. Standard construction measures to reduce hydromorphological impacts of in-stream works as described within the outline CEMP (Appendix A2).	National	Moderate adverse significance, reducing to negligible as the re-provisioned reens aquatic and marginal flora and invertebrate assemblage start to establish.
Semi-improved neutral grassland	Loss of 16.91 hectares of semi-improved neutral grassland (4.98ha of which is the Marshfield SINC).	12.12ha of species-rich grassland provided across the proposed development, mostly provided prior to loss of other semi-improved neutral grassland due to phasing strategy. Soils and turfs from the SINC will be translocated into the species-rich grasslands to be created south of the railway.	County and local	Minor adverse significance, reducing to negligible as the created grasslands start to establish.
Woodland	Loss of 0.92 ha of dry woodland and 0.49 ha of wet woodland.	Creation of 1.8 hectares of dry hazel dominant woodland and 0.8 hectares of wet woodland, most of which will be provided prior to removal of existing habitat due to phasing strategy.	County and local	Moderate adverse significance, reducing to minor adverse as the woodlands start to establish.
Hedgerows	Loss of 3.57km of hedgerow, with only 210m being species-rich hedgerow the remining being species-poor.	Creation of 4.2km species-rich hedgerows, the majority of which will be planted prior to removal of existing hedgerows due to phasing strategy.	County and local	Moderate adverse significance, reducing to minor adverse as planting starts to establish.
Other habitats	Loss of other habitats, including 3.47 ha of poor semi-improved grassland.	Creation of 12.12ha of species-rich grassland and 0.4ha of scrub, mostly provided prior to loss of existing habitats due to phasing strategy.	Local	Negligible significance.
		Protected Species		
Foraging and commuting bats	Loss of 4.43km of the reen network, 0.92 ha of dry woodland, 0.49 ha of wet woodland and 3.57km of hedgerow.	Creation of 3.72km of wet reens, 1.8 hectares of dry hazel dominant woodland, 0.8 hectares of wet woodland, and 4.2km species-rich hedgerows, the majority of which will be planted prior to removal of existing habitats due to phasing strategy.	County and local	Moderate adverse significance, reducing to minor adverse as planting starts to establish.
Foraging and commuting bats	Habitat severance and fragmentation, and disturbance.	Dead hedging to maintain foraging and commuting corridors, sensitive timing of works, with works within the bat activity period kept to a minimum. Temporary construction lighting required within bat activity periods will be directional lighting and designed to ensure no light spill over 0.5 Lux on to any identified commuting and foraging areas.	County and local	Minor adverse significance.

Ecological receptor	Potential impact	Embedded design, assumed construction practices and mitigation	Value of receptor	Residual significance of effect during construction
Dormice	Loss of 0.92 ha of dry woodland, 0.49 ha of wet woodland and 3,574m of hedgerow	Translocation of a portion of the population and displacement methods during vegetation clearance to be undertaken and agreed through an EPS licence. Dead hedging to maintain connectivity and creation of 1.8 hectares of dry hazel dominant woodland, 0.8 hectares of wet woodland, 0.4ha of scrub, and 4.2km species-rich hedgerows, the majority of which will be planted prior to removal of existing habitats due to phasing strategy.	Regional	Minor adverse significance, reducing to negligible as planting starts to establish.
Otter	Loss of habitats suitable for otter (woodland close to watercourses, and 4.43km of the reen network).	Creation of 3.72km of wet reens, 1.8 hectares of dry hazel dominant woodland, and 0.8 hectares of wet woodland.	Local	Minor adverse significance, reducing to negligible as the new habitats become available.
Otter	Temporary disturbance and severance of habitat.	Temporal restrictions to working and exclusion zones, such as avoiding works in certain areas at certain times, and control of noise or light spill may be implemented, which will be detailed within the EPS development licence the final CEMP. Night-time lighting will be designed to ensure no light spill over 0.5Lux onto identified otter habitats. The negative effects of habitat severance and isolation will be mitigated by careful construction programming, the maintenance of safe crossing places for otters, and the installation of temporary and / or permanent fencing to funnel otters towards these crossing which will be detailed within the EPS development licence and the final CEMP. Enhancement could be sought through the provision of artificial holt away from construction areas.	Local	Moderate adverse significance, reducing to minor adverse once the crossings over and works around Primary reens are complete and exclusion zones established and inclusion of artificial holt.
Water vole	Loss of 2.57km of secondary / ephemeral reens and 154m of wet ditches. Habitat severance and fragmentation and temporary disturbance.	Creation of 3.72km of wet reens, with 3m base, 1 in 1 slopes and a 1m wide shelf just above water level on the south-facing side (or both sides space permitting); preferably at least 80cm deep and 2m wide at water level. Displacement by habitat manipulation or capture and translocation (which will be detailed within a water vole licence issued by NRW). Temporal restrictions to working and exclusion zones, such as avoiding works in certain areas at certain times, and control of noise or light spill may be implemented, which will be detailed within the NRW development licence the final CEMP. Night-time lighting will be designed to ensure no light spill over 0.5Lux onto identified water vole habitats.	County	Moderate adverse significance, reducing to minor adverse as planting along reens starts to establish.
Amphibians	Loss of habitat suitable for amphibians (no great crested newt recorded). Injury and/or mortality during construction works.	Standard construction measures to reduce hydromorphological impacts of in-stream works and impacts from potential pollution events as described within the outline CEMP (Appendix A2). Amphibians would also be caught and moved to safety during the electric fishing techniques for fish species (during de-watering of reens).	Local	Negligible significance.
Badger	No setts were identified within the planning boundary during the field surveys, and the area of the proposed	Badger setts are protected under legislation, as such a pre-construction survey for badger setts would be required within 3 months prior to any construction activities within the proposed development. If any setts are	Less than local	No effect.

Ecological receptor	Potential impact	Embedded design, assumed construction practices and mitigation	Value of receptor	Residual significance of effect during construction
	development is considered suitable for commuting and foraging badger only.	located a badger licence and associated mitigation may be required, by issue from NRW. Construction mitigation for other protected species, such pollution preventions, night time lighting restrictions, covering of excavations, speed limits for vehicles, would also mitigate negative effects for commuting and foraging badgers.	(protected species)	
Breeding birds	Disturbance and displacement associated with construction activities, and breeding habitat loss, primarily of arable / pastoral land and hedgerows. Nest destruction could also occur in the absence of mitigation measures.	Pollution control measures and timing of vegetation clearance to avoid impacts on nesting birds are detailed within the outline CEMP (Appendix A2).	Local	Negligible significance.
Wintering birds	Loss of potential foraging habitat within grassland and arable fields.	N/A - No species listed as qualifying features of the Severn Estuary SPA or Ramsar site were recorded, and only a low number of species that contribute to the assemblage feature qualification of both the SPA and Ramsar site were recorded, with a peak count representing 0.93% and 0.70% of the Ramsar and SPA assemblage population, respectively.	Local	Negligible significance.
Barn owl	Loss of 16.91 hectares of semi-improved neutral grassland, 12.04ha of improved grassland, 3.47 ha of poor semi-improved grassland, and 10.03ha of arable land. Loss of two potential secondary nesting and/or roosting sites (TN11 and TN13 on Figure 2 Appendix E2 and T21 and T5 in Appendix E6). Disturbance, habitat severance, and direct species mortality (due to collision with construction vehicles).	Provision of barn owl nesting boxes and creation of 12.12ha of species-rich grassland, mostly provided prior to loss of existing habitats due to phasing strategy. Any disturbance activities within the vicinity of identified breeding sites and roosting sites will need to be sensitively timed with exclusion zones established, and controls of noise and light spill enforced. Site speed limits will be in place and work timings specified in the outline CEMP (Appendix A2), which will reduce risks of collisions.	Local	Minor adverse significance.
Reptiles	Direct impacts through removal of habitat or accidental killing of individuals.	Habitat manipulation and creation strategies to displace any reptiles present have been detailed above and within the outline CEMP (Appendix A2).	Less than local (protected species)	Negligible significance.
Fish (European eel and Lamprey species)	Loss of 4.43km of secondary reens and ditches habitat (although only 2.72km were recorded to be wet) that is known to support a population of European eel and possibly Lamprey species. A number of retained reens	Creation of 3.72km of wet reens with 3m base and 1 in 1 slopes, all of which would be unshaded promoting in-stream macrophyte growth which would provide refuge habitat for European eel. Measures to mitigate for changes in water flow, water level and / or changes in water quality are set out in the Hydrology and flooding assessment, Chapter 5.	Local	Negligible significance.

Ecological receptor	Potential impact	Embedded design, assumed construction practices and mitigation	Value of receptor	Residual significance of effect during construction
	may also be subject to alterations in water flow or level, resulting in disturbance to European eel during construction (see the Hydrology and flooding assessment, Chapter 5). Direct injury and/or mortality of fish during the de-watering of reens and construction activities.	Fish translocation prior to dewatering, under licence, to suitable local habitat agreed with NRW fisheries/biodiversity officer.		
Terrestrial invertebrates	Loss of 16.91 hectares of semi-improved neutral grassland, habitat severance, and direct mortality (during site clearance).	Creation of 12.12ha of higher quality (more diverse) species-rich grassland and 0.4ha of scrub, mostly provided prior to loss of existing habitats due to phasing strategy, planted and managed to provide suitable habitat for the shrill carder-bee and the brown-banded carder-bee. Selected turfs and soils translocated from the semi-improved grasslands within the SINC. Negative impacts to be reduced by sensitive timing of habitat clearance and removal.	Local	Minor adverse significance, reducing to negligible as planting starts to establish.
Aquatic invertebrates	Loss of 2.57km of secondary / ephemeral reens and 154m of wet ditches. Direct injury and/or mortality during the de-watering of reens and construction activities.	Creation of 3.72km of wet reens with 3m base and 1 in 1 slopes, all of which would be unshaded promoting in-stream macrophyte growth which would provide habitat for aquatic invertebrates. Measures to mitigate for changes in water flow, water level and / or changes in water quality are set out in the Hydrology and flooding assessment, Chapter 5.	Local	Negligible significance.
Other Section 7 species (potential for hedgehog, brown hare and polecat)	Permanent and temporary habitat loss, severance and disturbance, as well as individual mortality.	Habitat creation, most of which would be realised before the end of construction, would also provide alternative habitats for these species. Provisions would be made by the ECoWs for any animals found during construction which need to be moved.	Local	Negligible significance.

Table 7.21: Summary of assessment of residual operational effects for ecological receptors of local and above value and/or legal protection[94]

Ecological receptor	Potential impact	Embedded mitigation	Value of receptor	Significance of effect during operation
		Habitats		
Severn Estuary SAC, SPA, Ramsar site	Hydrologically connected to the proposed development drainage, and as such could be affected by fuel and chemical spills from roads and hard standing areas. Barriers to fish.	SuDS would be implemented across the site to manage rainfall using methods that mimic natural process, by using landscape and vegetation to control the flow, volume and quality of the surface water runoff. The storm water drainage strategy and flood mitigation proposals have been designed to ensure no dewatering of existing reens and interconnectivity between reen network is maintained. No permanent barriers to SPA or Ramsar site fish species are proposed.	International	Negligible significance.
River Usk SAC	Disturbance and direct injury and/or morality through vehicle collision.	12.5m buffer from main reens and hedgerow and woodland planting to enhance habitat. Otter ledges in the culverts crossing Feandre reen and main road crossing Ty Ffynon reen, and otter fencing will reduce the potential impact of otter vehicle collisions by providing safe passage and connected habitats. Enhancement could be sought through the provision of artificial holt away from operational areas.	International	Negligible significance.
Gwent Levels – Rumney and Peterstone SSSI	Loss of 4.43km of the reen network (2.57km secondary / ephemeral reens and 154m of which were wet ditches). Hydrologically connected to the proposed development drainage, and as such could be affected by fuel and chemical spills from roads and hard standing areas.	Reen re-provision of 3.72km of wet reens with 3m base and 1 in 1 slopes. SuDS would be implemented across the site to manage rainfall using methods that mimic natural process, by using landscape and vegetation to control the flow, volume and quality of the surface water runoff. The storm water drainage strategy and flood mitigation proposals have been designed to ensure no dewatering of existing reens and interconnectivity between reen network is maintained.	National	Negligible significance.
Marshfield SINC	Loss of 4.98ha of semi-improved neutral grassland within the SINC.	12.12ha of species-rich grassland provided across the proposed development. The created grasslands south of the railway, which would include translocated turfs and soils from the SINC, have the potential to provide a biodiversity net gain of higher valued habitats; however, the value of these habitats is dependent on the monitoring and management of the created grasslands which is described in Section 7.12.	County	Negligible significance.
Higher biodiversity value habitats	Gains in higher biodiversity value habitats including wet woodland, woodland, species-rich hedgerows, secondary reens, and scrub.	Habitat creation of certain higher biodiversity value habitat types exceeds those being lost: • 0.8ha of wet woodland (ratio 1:1.62 or 63% increase), • 1.8ha of woodland (hazel dominate) (ratio 1:1.95 or 15% increase), • 12.12ha species-rich grasslands; 8.92ha being 'dry' and 3.2ha being wet in the FCA (ratio 1:0.91 or an 8% reduction),	National, county and local	Minor beneficial significance.

[94] Ecological receptors not listed within this table have the same residual effect as predicted for construction, or have no further impacts relating to operational effects.

Ecological receptor	Potential impact	Embedded mitigation	Value of receptor	Significance of effect during operation
		• 4.2km of species-rich hedgerows (ratio 1:20.5 or 1773% increase of species-rich hedgerow; and 1:1.18 ratio or an 9% increase of total length of hedgerow), • 3.72km of wet reens (ratio 1:1.37 or 37% increase), and • 0.4ha of scrub habitat within the Wildlife Corridor (no ratio as no scrub is being lost).		
		<u>Protected Species</u>		
Foraging and commuting bats	Loss of 4.43km of the reen network, 0.92 ha of dry woodland, 0.49 ha of wet woodland and 3,574m of hedgerow, and habitat severance. Direct injury and/or mortality through vehicle collision.	Creation and enhancement of commuting and foraging routes, including a 63% increase of wet woodland, a 15% increase of dry (hazel dominant) woodland, an 9% increase in hedgerows, and a 37% increase in wet reens. Provision of structures to aid bats to cross new roads at safely.	County and local	Minor beneficial significance.
Roosting bats	N/A – no roosts found	The provision of at least 20 bat boxes throughout the proposed development would enhance the bat roosting habitat within the site.	County and local	Moderate beneficial significance.
Dormouse	Loss of 0.92 ha of dry woodland, 0.49 ha of wet woodland and 3,574m of hedgerow, and habitat severance Direct injury and/or mortality through vehicle collision.	Translocating a proportion of the existing 'at capacity' population considered to be at its southern extent, enhancing the habitats for the remaining population (63% increase of wet woodland, a 15% increase of dry (hazel dominant) woodland, an 9% increase in hedgerows (and a 1773% increase in species-rich hedgerows), and creation of 0.4ha of scrub), alongside the provision of new structures to aid dormice in crossing new roads safely, would encourage a healthy population structure and expansion.	Regional	Moderate beneficial significance.
Otter	Loss of 2.57km of secondary / ephemeral reens and 154m of wet ditches, disturbance and direct injury and/or morality through vehicle collision.	Creation of 3.72km of wet reens, 12.5m buffer from main reens and hedgerow and woodland planting to enhance habitat. Light spill on to reens and their bank side vegetation will be minimised to reduce disturbance effects. Otter ledges in the culverts crossing Feandre reen and main road crossing Ty Ffynon reen, and otter fencing will reduce the potential impact of otter vehicle collisions by providing safe passage and connected habitats. Enhancement could be sought through the provision of artificial holt away from operational areas.	Local	Moderate beneficial significance.
Water vole	Loss of 2.57km of secondary / ephemeral reens and 154m of wet ditches and increased disturbance	Creation of 3.72km of wet reens, with 3m base, 1 in 1 slopes and a 1m wide shelf just above water level on the south-facing side (or both sides space permitting); preferably at least 80cm deep and 2m wide at water level. Primary reens will have vegetated buffers between the reen banks and hard development of 12.5m on each side. Light spill on to reens and their bank side vegetation will be minimised to reduce disturbance effects	County	Moderate beneficial significance.

Ecological receptor	Potential impact	Embedded mitigation	Value of receptor	Significance of effect during operation
		to water vole and encourage continued use of retained reens adjacent to developed areas. The area south of the railway line for water voles will not be lit. A Mink Control Programme will be written in agreement with NRW and carried out within the proposed development and in areas agreed with NRW and landowners.		
Amphibians	Loss of 2.57km of secondary / ephemeral reens and 154m of wet ditches	Creation of 3.72km of wet reens. Provision of drainage culverts to maintain hydro-connectivity. SuDS would be implemented across the site to manage rainfall using methods that mimic natural process, by using landscape and vegetation to control the flow, volume and quality of the surface water runoff. The storm water drainage strategy and flood mitigation proposals have been designed to ensure no dewatering of existing reens and interconnectivity between reen network is maintained.	Local	Minor beneficial significance.
Breeding birds	Loss of 0.92 ha of dry woodland, 0.49 ha of wet woodland and 3,574m of hedgerow	A 63% increase of wet woodland, a 15% increase of dry (hazel dominant) woodland, an 9% increase in hedgerows, and creation of 0.4ha of scrub, as well as an increase in the quality of marginal reen habitat. The provision of at least 20 bird boxes would be provided as additional nesting habitat for bird species, including those which may not be present within the site currently.	Local	Minor beneficial significance.
Terrestrial invertebrates	Loss of 16.91 hectares of semi-improved neutral grassland.	Creation of 12.12ha of higher quality (more diverse) species-rich grassland and 0.4ha of scrub, as well an increase in quantity and quality of hedgerows and woodlands (increase of 63% of wet woodland, 15% of woodland (hazel dominate), and 9% of hedgerows). Areas manged for carder-bee populations.	Local	Minor beneficial significance.
Aquatic invertebrates	Loss of 2.57km of secondary / ephemeral reens and 154m of wet ditches	Creation of 3.72km of wet reens with 3m base and 1 in 1 slopes, all of which would be unshaded promoting in-stream macrophyte growth which would provide an overall enhanced habitat for aquatic invertebrates within the site. Provision of drainage culverts to maintain hydro-connectivity.	Local	Minor beneficial significance.