Ecological Connectivity Assessment of Settlements in Monmouthshire Report

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Ecological Connectivity Assessment of Settlements in Monmouthshire May 2010

For and on behalf of Gwent Ecology (GE)

Approved by: *Dr Richard Park*

Signed: 

Position: *Chief Executive, Gwent Wildlife Trust*

Date: *10th May 2010*

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Contents

Table of Figures

1. Executive Summary

There is a growing emphasis on ecological connectivity and landscape scale approaches to nature conservation, as concerns about climate change have highlighted the problems of habitat loss and fragmentation for biodiversity.

The connectivity assessment comprised two main parts, firstly focusing on the connectivity of semi-natural habitats/features and secondly examining connectivity for a single selected species for each settlement.

The largely desk-based assessment focused on the production of a suite of MapInfo GIS layers, providing a visual display of existing connectivity and opportunities for enhancing connectivity within each settlement. The assessment focused on thirteen settlements within the Local Authority area of Monmouthshire identified as key areas for development through the Local Development Plan (LDP) process.

A defined method using GIS datasets for habitats was used to identify the Existing Habitat Connectivity. This formed the basis for identification of Connectivity Opportunities in settlements. For each settlement, a selected species; great crested newt, otter or dormouse was considered, identifying its primary habitat and opportunities for enhancing connectivity.

The assessment identifies a variety of routes of habitat connectivity within the settlements. In many cases these are dominated by linear features such as major watercourses and the verges of major roads and railways. These often link with other blocks of semi-natural habitat (for example woodlands and semi-improved grassland) and beyond the settlement boundaries to areas of semi-natural habitat in the wider landscape. The settlements include a relatively large number of locally, nationally and internationally ecological important sites. Opportunities to improve connectivity include enhancing links between the linear routes and also to more isolated blocks of semi-natural habitat, which are sometimes very small and scattered across the settlement.

This study is primarily intended to inform the developing LDP in Monmouthshire but will be a useful tool for a wide range of projects and departments within Monmouthshire County Council (MCC). It could be used to inform Development Control processes, provide a focus for Highways and Public Rights of Way biodiversity improvements and to provide a focus for improving the management regime of some council managed sites.

The study is designed to be adaptive and could easily be updated as more information is gathered. Additional species studies or habitat quality information would be ideal. In this manner, the study could form an excellent indicator for performance in this area for the future.

It is timely that whilst undertaking this assessment, CCW have released details of The Econet Toolkit – A GIS approach to Ecological Connectivity[1]. This provides a useful tool which compliments this study and will allow further assessment of ecological connectivity and identification of enhancement opportunities into the wider area of the county of Monmouthshire.

[1] Countryside Council for Wales (2009)

2. Introduction

2.1 Context

In recent years, there has been a growing emphasis on ecological connectivity and landscape scale approaches to nature conservation, as concerns about climate change have highlighted the problems of habitat loss and fragmentation for biodiversity. Such approaches have wide political recognition and are referred to in key documents such as Article 10 of the EC Habitats Directive[2] (Council Directive 92/43/EEC) and the UK Biodiversity Action Plans (BAPs)[3].

The interest in improving connectivity lies with the underlying premise that the issues of a fragmented natural landscape, together with the possible impacts of climate change, may be eased through improved ecological connectivity. A consideration of existing ecological connectivity and ways in which it can be enhanced, can help the planning of effective biodiversity conservation[4]. General guidance for planning action has been set out in a report to the UK Biodiversity Partnership[5] describing approaches to tackling the causes of climate change. Here, one of the measures for conservationists is to establish ecological networks through habitat protection, restoration and expansion.

Many of our best wildlife habitats survive today as fragmented pockets in the landscape. Fragmentation has occurred as wildlife habitats have been lost and isolated through land-use change and intensification. As a result, patches of habitat may become too small to support populations of species, and their movement within the landscape, for foraging, migration and dispersal is interrupted.

New and large scale approaches are necessary to reverse some of these changes and conserve our biodiversity. Habitat restoration requires improvements to ecological connectivity of the landscape, in order to reverse the effects of fragmentation and enable species to move more naturally.

Existing 'hotspots' for biodiversity should be central to any planning to improve connectivity. They are the sources for future population movement and expansion. Protected sites in particular should be a focus[6]. Efforts to improve connectivity should both bolster the size and quality of these existing hotspots, conserving this existing resource, whilst also furthering links between sites through restoring degraded habitats in between.

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[2] EC Habitats Directive (1992). Implemented in UK law through the Habitats Regulations (1994).
[3] UK BAP. UK Government's response to the Convention on Biological Diversity (signed in 1992).
[4] Latham *et al*
[5] Hopkins *et al* (2007)
[6] e.g. National Nature Reserves (NNRs), Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), Sites of Importance for Nature Conservation (SINCs).

2.2 Policy Background

Monmouthshire has a wealth of protected species and important wildlife habitats and has a relatively large number of internationally and nationally protected sites[7]. Work is on going, not only to continue to designate sites of conservation importance, but to maintain existing ones in 'favourable condition'[8].

On a local scale, work has begun to designate local sites of biological importance in Wales. Sites of Importance for Nature Conservation (SINCs) is the recognised term used in Welsh Assembly Government (WAG) planning guidance and local planning policies, and is therefore the term used within Monmouthshire. This local designation helps to conserve important and distinctive habitats and species on sites that fall outside of European (EU) or UK conservation designations. A SINC may be considered a Local Wildlife Site (LWS) when the landowner's agreement has been received and management advice and potential funding have been provided.

The long term vision in Monmouthshire is to develop a fully functioning LWS system and this is work in progress. To date, approximately 266 species-rich grassland sites have been designated as SINCs and also have Local Wildlife Sites status[9]. In addition, four watercourses have been designated as SINCs and 393 ancient and semi-natural woodlands await approval as SINCs so far.

The Environment Strategy for Wales[10] acknowledges that despite the provision of these protected sites, biodiversity is coming under increasing pressure from many directions. The Strategy suggests that these pressures need to be addressed by developing a more dynamic and flexible approach to managing biodiversity. In order to improve habitat management and reduce habitat fragmentation, the wider environment needs to be more supportive of biodiversity. One of the major long term outcomes which the Strategy advocates is that: *"The wider environment is more favourable to biodiversity through appropriate management, reduced habitat fragmentation and increased extent and interconnectivity of habitats."*

This is clearly supported through Regulation 37 of The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)[11]: *Nature Conservation Policy in Planning Contexts 37.— "For the purposes of the planning enactments mentioned below, policies in respect of the conservation of the natural beauty and amenity of the land shall be taken to include policies encouraging the management of features of the landscape which are of major importance for wild flora and fauna. Such features are those which, by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems of marking field boundaries) or their function as stepping stones*

[7] SACs, SPAs, Ramsar sites & SSSIs, NNRs
[8] Environment Strategy for Wales, WAG (2006)
[9] Gwent Grasslands Initiative Project (2005-2008), Gwent Wildlife Trust
[10] WAG (2008)
[11] Also referred to as the Habitats Regulations (1994)

(such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species."
The ability of policies to deal with future challenges such as climate change is an important issue acknowledged in The Wales Spatial Plan (2008). Specific policies have been assessed for such ability in more detail by the Environment Agency[12]. Clearly, appropriate policies for biodiversity should enable acceptable levels of adaptation. For example, policies advocating a site-based conservation strategy alone may begin to look ineffective if the majority of species in the protected sites migrate northwards as the climate changes.[13] Creating ecological networks that improve connectivity between habitat patches and allow species to disperse over larger areas will enhance the resilience of the landscape and further increase the probability of species surviving[14].

Forward Planning and the Development Control process clearly have an important role to play in contributing to the maintenance of existing networks but also by striving to strengthen existing links and create new connections[15].

The outputs of the project presented here are intended to be used as a tool to help deliver these goals within the key settlement areas of Monmouthshire.

2.3 The Concept of Ecological Connectivity

Ecological Connectivity has no single, simple definition and can be interpreted in a variety of ways: from the simple physical connections between habitat patches, requiring the development of continuous corridors of habitat, to ecological connectivity in a broader sense; relating to the overall amount and distribution of habitat in the landscape, the permeability of land between habitat patches and the size, shape and condition of habitat patches[16].

The assessment of ecological connectivity outlined here focuses on the physical component of connectivity and takes a broad, simple approach, focusing on connectivity at a habitat level. The focus is on physical connectivity between key semi-natural habitats and sites within the identified Monmouthshire settlements.

[12] Environment Agency (2008)
[13] Parmesan and Yohe, 2003, Thomas *et al. (*2004)
[14] Department for the Environment Food and Rural Affairs, (2007).
[15] Planning Policy Wales, WAG 2002. Draft Technical Advice Note (TAN) 5, Welsh Office (1966/2006)
[16] Latham *et al*

2.4 Opportunities to strengthen existing habitat connectivity

The existing semi-natural habitat networks highlighted in this study provide the best focus for remedial improvements to connectivity.

In this context some broad principals for improving connectivity can be usefully applied to all settlements:

- Maintain the existing semi-natural resource/biodiversity features through sensitive management and appropriate protection (e.g. ensure favourable condition of SACs, SSSIs and SINCs). The primary routes of existing connectivity as displayed in the Habitat Connectivity Maps should be the focus for this, in conjunction with preserving all semi-natural habitats as outlined on the Semi-Natural Habitat Base Layers.
- Build upon and expand the size of the semi-natural resource. Again the existing routes of connectivity provide the core resource on which to concentrate habitat expansion efforts. Use these biodiversity features as a focus on which to build and strengthen, e.g. expanding the density and improving the permeability of semi-natural habitats.
- Work to strengthen and widen existing linear features which provide important wildlife corridors in a fragmented landscape.
- Do not truncate existing habitat links and work to consolidate them.

Many of these actions to improve connectivity can be affected through sensitive habitat management. Standard management recommendations for the priority habitats used within this study are presented within Section 6.1: Management Recommendations.

2.5 Opportunities to further enhance habitat connectivity

Another way of improving connectivity is to build connections between often segregated habitats through restoration of the land which lies in between. The Habitat Connectivity Opportunities maps provide an assessment (based on the methodology defined in this report) of where these habitat linkage opportunities lie within each settlement.

These are areas of a settlement where two semi-natural habitats are within 205m of each other. Bridging the gaps could be addressed in a variety of ways including through habitat restoration or creation.

The Habitat Connectivity Opportunities maps identify the major examples for enhancing connectivity through bridging gaps. It should be remembered that many more local opportunities to enhance habitat connectivity between smaller patches of semi-natural habitat may exist.

The opportunities displayed in the Habitat Connectivity Opportunities maps are theoretical. They giving no consideration to features which may serve as non changeable barriers to connections on the ground, for example built

structures (roads, buildings, central urban zones) or the presence of existing linkages between semi-natural habitats not picked up within the study. For example hedgerows may in some cases already provide a link where a gap has been identified.

3. Initial Brief and Required Outputs

3.1 The brief

The requirements for this assessment were laid out in the document *Monmouthshire Local Development Plan – Biodiversity Proposal* and in particular *Section 2.3: Ecological Connectivity Assessments of Settlements.*

Although the study stayed true to the original aim, the brief has evolved through discussion between MCC and GE leading to the following requirements:

- To produce one set of paper maps, one map for each settlement covered, and an electronic MapInfo GIS layer showing the areas important for providing ecological connectivity.
- To produce a paper map and an electronic MapInfo GIS layer showing how the settlements were broken down into smaller divisions where appropriate.
- To produce a technical report on the methodology used, a report detailing the criteria against which areas were evaluated in terms of their biodiversity interest, and a description of the method used for this evaluation.
- To produce a report for each settlement and where appropriate, sub-division highlighting the connectivity value (i.e. justification for inclusion in the MapInfo GIS layer) and any management recommendations.

The final settlement list for the Ecological Connectivity Assessment was informed by the LDP Spatial Strategy[17]. The following thirteen settlements have been identified as areas where the majority of development will be directed:

Main Settlements:
Abergavenny
Llanfoist
Caldicot
Portskewett
Chepstow
Monmouth
Magor
Undy

Secondary Settlements:
Usk
Penperlleni
Rogiet
Raglan
Sudbrook

Due to the close proximity between some of these settlements, some were aggregated for the purposes of this assessment and numbered as shown in Figure 1.

[17] Monmouthshire Local Development Plan Preferred Strategy (2009)

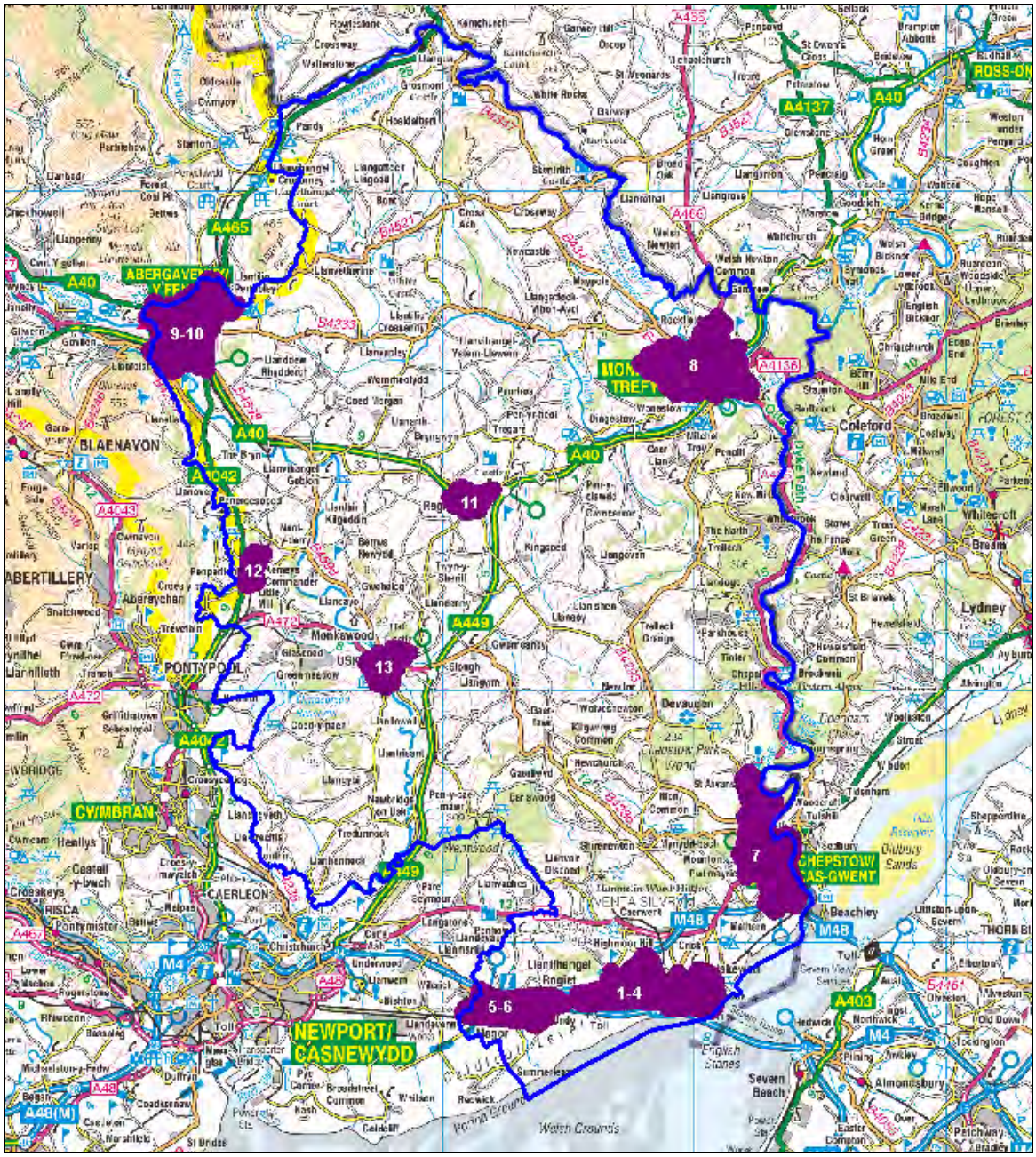


Figure 1: Location Map for Monmouthshire Settlements
(Blue line indicates Monmouthshire LA boundary)

Settlements 1-4:	Caldicot, Portskewett, Rogiet & Sudbrook
Settlements 5-6:	Magor & Undy
Settlement 7:	Chepstow
Settlement 8:	Monmouth
Settlement 9-10:	Abergavenny & Llanfoist
Settlement 11:	Raglan
Settlement 12:	Penperlleni
Settlement 13:	Usk

3.2 Outputs

MapInfo GIS Layers

For each of the settlements the following features were defined and illustrated in MapInfo GIS Layers:

Layer 1: Settlement Buffer Boundary
Layer 2: Water Features
Layer 3: Woodlands & Hedgerows
Layer 4: Semi-Improved Grassland
Layer 5: Other Linear Features
Layer 6: Existing Habitat Connectivity
Layer 7: Additional Habitat Patches
Layer 8: Opportunities to Extend Habitat Connectivity
Layer 9: Great Crested Newt Existing Connectivity*
Layer 10: Great Crested Newt Opportunities to Extend Connectivity*
Layer 11: Dormouse Existing Connectivity*
Layer 12: Dormouse Additional Potential Habitat*
Layer 13: Dormouse Opportunities to Extend Connectivity *
Layer 14: Otter Existing Connectivity*
Layer 15: Otter Opportunities to Enhance Connectivity *
* *Only for selected settlements*

The MapInfo GIS Layer Files are described in more detail within Section 4: Methodology.

A set of paper maps and electronic MapInfo GIS Layers is provided for each settlement.

In undertaking the ecological connectivity assessment, a series of other MapInfo GIS 'working layers' were created, to help support the process. These were made available to MCC but are not described in this report.

3.3 The report

A paper and digital copy of a report including:

- Assessment Methodology
- A description of the criteria used to determine areas of biodiversity interest.
- A description of the methodology employed to determine primary examples of existing habitat connectivity and opportunities for enhancing habitat connectivity.
- A description of the methodology employed to determine examples of existing habitat connectivity and opportunities for enhancing habitat connectivity for selected species within Monmouthshire.

- Settlement Reports: Reports for each settlement, highlighting existing connectivity and opportunities for enhancing connectivity in relation to both habitats and selected species.
- A discussion of general management recommendations.

4. Methodology

4.1 Overview

The methodology below describes the process carried out to assess both existing ecological connectivity, and opportunities for enhancing ecological connectivity within the study areas in Monmouthshire.

The assessment comprised two main parts, firstly focusing on the connectivity of semi-natural habitats/features and secondly examining connectivity for a single selected species for each settlement. Ecological connectivity is considered to be of particular importance for these species, which are known to find an important home in Monmouthshire.

The assessment was largely desk-based and focused on the production of a suite of MapInfo GIS layers, providing a visual display of existing connectivity and opportunities for enhancing connectivity within each settlement. MapInfo Professional 9 was used to construct the layers.

The names of these layers are **given in bold** within the relevant sections below. In undertaking the ecological connectivity assessment, a series of other GIS layers were created to help inform the process. These were also provided to MCC in support of the main layers, although are not described here.

4.2 The Process – Habitat Connectivity & Opportunities Assessment

Phase 1: Defining the Study Area

The assessment focused on thirteen settlements within the Local Authority area of Monmouthshire (Figure 1). These thirteen settlements were identified as key areas for development through the LDP process.

A boundary line was drawn around each of the settlements existing development boundary (as identified in the Monmouthshire Unitary Development Plan) and extended to include the following sites, submitted through the LDP process:

- Strategic Candidate Sites– sites that are potentially compatible with the LDP Preferred Strategy and have been identified by MCC as being of strategic importance.
- Candidate Sites that meet the Preferred Strategy – sites that have been identified as compatible with the LDP Preferred Strategy.

A 250m buffer was then applied to this boundary line to give the final study area for each settlement. This ensured that an area beyond the potential development boundary i.e. connectivity into the wider landscape, was given regard within the assessment.

This layer is named **Settlement Buffer Boundaries** (Layer 1).

Phase 2: Identifying Existing Semi-Natural Habitats and Features – The Base Layers

In order to assess existing ecological connectivity, the first step was to map key semi-natural habitats and features within each Settlement Buffer Boundary. These represent key areas of biodiversity interest within the settlements.

Through a combination of Wales wide data sets and local survey data there is a reasonable level of information available for habitats and important sites for biodiversity across Monmouthshire (Figure 3). The following semi-natural habitats were mapped within the buffer boundary for each settlement:

Water Features (Layer 2)
Woodlands & Hedgerows (Layer 3)
Semi-Improved Grassland (Layer 4)

All semi-natural habitats can play a role in aiding the movement of species in the landscape. However, the three broad habitat groups above were chosen to reflect key habitats and opportunities for movement of species within Monmouthshire. Each is identified as a UK BAP Priority habitat and through the Local Wildlife Sites (also referred to as Sites of Interest for Nature Conservation or SINCs) and LBAP processes have been identified as local priorities in Monmouthshire.

Woodlands, hedgerows and waterbodies can be effectively mapped from aerial photography and existing habitat data sets, and often represent key linear features for species movement and habitat linkage. In the case of grasslands, Monmouthshire supports a significant proportion of the Welsh resource and the Gwent Grasslands Initiative[18] provides a comprehensive assessment of the semi-improved and unimproved grassland resource.

In addition, a fourth layer map was created to include other linear features (e.g. dual carriageways and motorway verges, railway lines and old viaducts). These features by their very nature provide long stretches of uninterrupted habitat and have the potential to be managed sympathetically. This layer helps to ensure that linear features of potential importance for connectivity, but which may not be captured in the other layers, are included within the assessment. This layer is named **Other Linear Features** (Layer 5).

The four layers described above collectively form the Base Layers that are used to inform the next phases of the assessment.

A summary of the MapInfo GIS layers created and justification for inclusion of each broad habitat type is given in Figure 2.

[18] http://gwentwildlife.com/grasslands/wildlifeSites.htm

A summary of the datasets and other information used to inform the mapping of the Base Layers is given in Figure 3.

Figure 2: Base Layer Summaries

Base Layer	Features mapped on MapInfo GIS Layer	Justification for inclusion of habitat/feature as a Base Layer
Water Features (Layer 2)	Includes main watercourses, reens, field ditches, ponds, lakes, streams and any other waterbodies mapped on OS map scale 1:10,000.	Identified as a local priority habitat in Monmouthshire through the SINC and LBAP processes.[19] No assessment of quality is made. All watercourses provide important potential corridors for species movement and habitat linkage and no assessment of quality is possible by aerials alone. Therefore mapping is inclusive of all waterbodies.
Woodlands & Hedgerows (Layer 3)	Includes hedgerows regardless of width, quality or management regime. Includes all woodland types, irrespective of quality, therefore includes Ancient Semi-Natural Woodland (ASNW), as well as any woodland, tree groups (including coniferous) as depicted on aerial photos. Includes small groups of trees and areas of dense scrub.	Identified as local priority habitats in Monmouthshire through the SINC and LBAP processes.[20] No assessment of quality is made. It is not possible to accurately and consistently assess hedgerow quality by aerials alone. All hedges (regardless of quality) have some biodiversity value and importantly the potential to be enhanced. Hedges are often vital wildlife resources and provide corridors in otherwise heavily managed areas. Therefore mapping is inclusive of any hedgerow regardless of quality. The same principle applies to woodlands.
Semi-Improved Grassland (Layer 4)	Semi-improved grassland is grassland that has not had significant fertilizer or herbicide applied to it. They are sometimes managed as grazing or as winter food for livestock - cutting for hay or silage. They are generally meadow or pasture land. Includes acid	Identified as a local priority habitat in Monmouthshire through the SINC and LBAP processes.[21] Semi-improved grasslands contain a high diversity of native plant species. They are particularly vulnerable to fragmentation and management changes. Monmouthshire has a high proportion of the remaining Welsh

[19] Monmouthshire LBAP Habitat Action Plan *to be written*: Ponds and marshy habitat
[20] Monmouthshire LBAP Habitat Action Plan 2: Boundary and Linear Features & Habitat Action Plan *to be written*: Woodland
[21] Monmouthshire LBAP Habitat Action Plan 1: Species-rich grasslands and floodplain pastures

	grassland, neutral grassland, calcareous grassland and marshy grassland types.	resource of semi-improved grasslands.
Other Linear Features (Layer 5)	Includes the verges of railways and major roads (dual carriageways and motorways). Also old viaducts.	Identified as a local priority habitat in Monmouthshire through the SINC and LBAP processes.[22] Road verges and railways often represent significant linear features and provide a degree of natural continuity and linkage though the landscape. They are usually remnants of semi-natural habitats in a biodiversity poor landscape and can provide connections between otherwise fragmented patches of semi-natural habitat.

[22] Monmouthshire LBAP Habitat Action Plan 2: Boundary and Linear Features

Figure 3: Information used to inform the mapping of the Base Layers

Base Layer	Information/Data sets used for mapping
Water Features (Layer 2)	Watercourse SINCs (GIS layer, SEWBReC) Wetland SSSIs (GIS layer, CCW) Rivers, streams and ponds (OS mapped features, map scale 1:10,000 and Mastermap). Aerial photo assessment of watercourse and standing water (aerial photo GIS layer from MCC) LDP Candidate Site Assessments
Woodlands and hedgerows (Layer 3)	Ancient Semi-natural Woodland (ASNW)– Ancient Woodland Inventory (GIS layer, CCW) Aerial photo assessment of hedgerows (aerial photo GIS layer from MCC) Aerial photo assessment of woodlands/tree groupings/small woodlands in urban environments (aerial photo GIS layer from MCC) Woodland SSSIs (GIS layer, CCW) LDP Candidate Site Assessments CCW: Broadleaved woodland core network & focal network (GIS layer, CCW) CCW: Ancient woodland core network & focal network (GIS layer, CCW) OS mapped features
Semi-improved grassland (Layer 4)	Gwent Grassland Initiative (GGI) grasslands (hard copy maps, GWT, 2005-2007) Grassland SINCs (GIS layer, GWT) CCW Phase 1 semi-improved rich & unimproved grasslands (GIS layer, CCW) Grassland SSSIs (GIS layer, CCW) LDP Candidate Site Assessments CCW: Unimproved grassland core network & focal network (GIS layer, CCW) CCW: Bog core network & focal network (GIS layer, CCW) CCW: Fen core network & focal network (GIS layer, CCW)
Other Linear Features (Layer 5)	Aerial photo and OS map assessment of linear features to include any verge which appears to host some semi-natural vegetation.

Where field survey was not possible, aerial photographs[23] provided the concluding reference point for cross checking of broad semi-natural habitat type. For example, woodland marked on the OS map does not always coincide with the situation displayed by aerial photos. In such instances mapping was led by the aerial photographs.

Phase 3: Identification of Existing Habitat Connectivity

Phase 2 identified and mapped important habitats and features. Using this information the following steps identify the primary routes of connectivity at the settlement scale and create an **Existing Habitat Connectivity Layer** (Layer 6).

Hedgerows and unconnected ponds were excluded from this phase of the mapping assessment. Hedgerows are significant linear features within the settlements, and are invaluable features for ecological connectivity at both the field and landscape scale. However, because of their function as field boundaries they tend to be regularly interrupted and their extensiveness mean inclusion in this step would prevent a simple, clear picture of primary routes of connectivity, which was the aim. In addition, hedgerows are considered separately during the species assessment for Dormice (Phase 5). Ponds are also considered later in the analysis for Great crested newts (Phase 5).

Figure 4: Phase 3: Technical Method for Identification of Existing Habitat Connectivity

Step	Method
4.1	The 4 Base Layers created in Phase 2 were viewed in MapInfo simultaneously. Any two features that were physically connected were highlighted e.g. two discrete blocks of habitat and/or a linear feature. Features on the edge of the settlement buffer boundary that extended beyond this were included in the analysis i.e. if they were assessed as being physically connected to another block of habitat and/or a linear feature beyond the settlement buffer boundary they were accordingly highlighted within the settlement buffer boundary.

[23] Aerial photographs made available by MCC, plus those sourced from Google Map or similar web-based sources

4.2	A 10m buffer was added to these connected features as a means of highlighting these key features. The following rules are followed when creating this map: • All connected features were combined into one object. For example watercourses look disjointed in the Habitat Base Layer because they often go underground and then reappear above ground again further along their course. In reality we know that this is a single feature so wherever it was obvious that this was the case, those visible, disjointed sections of the watercourse were treated as one object. • Roads and railway tracks were treated as a single linear feature i.e. both sides of the road were combined as a single object (as well as all separate parts of roadside verges). This forms the Existing Habitat Connectivity Layer (Layer 6). This should be considered as a summary layer, highlighting the main examples of connectivity. It is therefore not intended to be accurate to the precise boundary line of semi-natural habitats or to show all connectivity on a finer scale.

Phase 4: Identification of Opportunities to Extend Habitat Connectivity

The layer map created in this phase is intended to be directly comparable to the Existing Connectivity Layer created in Phase 3. Hedgerows and ponds were excluded from this phase for the same reasons stated in Phase 3 and to enable direct comparisons to be made between the two layers.

Figure 5: Phase 4: Technical Method for Identification of Opportunities to Extend Habitat Connectivity

Step	Method
5.1	Average field length for the study areas was calculated to be 205m (321 field boundaries chosen at random across the study areas, Mean=205m, SDV=112.7m, Range=50-750m). This is a practical distance for implementing habitat enhancement and building upon connectivity, for example hedgerow or buffer planting is usually done along field boundaries. The Existing Habitat Connectivity Layer was viewed in conjunction with the Base Layers. Any two features that were within 205m of each other were identified using a buffer technique. A standard buffer of 102.5m was applied to all the features identified on the Existing Habitat Connectivity Layer and also to any **Additional Habitat Patches** (Layer 7) extracted from the Base Layers. The Additional Habitat Patches layer ensures that small, discrete areas of semi-natural habitat that are not part of the primary route of connectivity (i.e. aren't included in the Existing Habitat Connectivity Layer) can still be considered when assessing opportunities for enhancing habitat connectivity.

	The use of a 102.5m buffer means that features that are precisely 205m apart will have buffer boundaries that meet and any features closer than this distance will produce an overlap of the buffers.
5.2	Any regions of overlap between buffers created in Step 4.1 were extracted to create the **Opportunities to Extend Habitat Connectivity Layer** (Layer 8).

4.3 The Process – Species Connectivity & Opportunities Assessment

Ecological connectivity is vital to the movement of many species and therefore giving some regard to species is an important part of this assessment. This is achieved through the application of some broad principles focusing on selected species.

Phase 5: Selection of Species

Species alert layers were produced by the South East Wales Biological Records Centre (SEWBReC) under commission by MCC for the following species:

- Great crested newt *(Triturus cristatus)*
- Hazel dormouse *(Muscardinus avellanarius)*
- European otter *(Lutra lutra)*

Each species is a UK BAP Priority Species, protected by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), and defined as a local priority within the Monmouthshire LBAP.

Each species is also known to use semi-natural corridors for dispersal and they are all vulnerable to habitat degradation and the severing of commuting and foraging links within the landscape.

Historic records of these key species in Monmouthshire occur as resident and transient records and all three species utilise a mixture of the base layer habitats throughout their lives.

A summary of each species' status and habitat requirements can be found in Section 8: Species Summaries. For the purpose of this study, each species is examined in the context of what is widely accepted to be its primary habitat.

For each settlement, a single species was examined, looking at existing connectivity of its primary habitat and opportunities for enhancing connectivity. The species was selected according to the prevalence of species records and predominant habitat types within the settlement and surrounding area.

Species and habitats selected for each settlement are shown in Figure 6 below:

Figure 6: Selected Species for each Settlement

Settlement	Selected Species and Primary Habitat
1-4:Caldicot, Portskewett, Rogiet & Sudbrook	Great Crested Newts and Ponds
5-6: Magor & Undy	Otters and Watercourses
7:Chepstow	Dormice and Woodlands/Hedgerows
8: Monmouth 8:Monmouth	Dormice and Woodlands/Hedgerows
9-10:Abergavenny & Llanfoist	Great Crested Newts and Ponds
11:Raglan	Great Crested Newts and Ponds
12:Penperlleni	Otters and Watercourses
13:Usk	Great Crested Newts and Ponds

Phase 6: Assessment of Existing Connectivity and Connectivity Opportunities for Selected Species

The following methodologies were used to determine existing connectivity and opportunities to enhance connectivity for each species. The exact approach varies according to the species to account for their individual ecology. A brief account of each species and their use of different habitats are given to aid understanding of the choice of the species, and the methodologies used including their constraints.

Great Crested Newt

Great crested newts are widespread in Wales and may be numerous locally in parts of Monmouthshire. However, the species have suffered a decline across the UK in recent years due to loss of suitable breeding ponds, and the degradation and fragmentation of terrestrial habitats[24]. Great crested newts need both aquatic and terrestrial habitat. They use ponds and other standing water features during the breeding season but will forage, migrate and over-winter in surrounding habitats; rough grassland, scrubland and woodlands appear to be favoured habitats.[25]

There is considerable variation between individuals in the amount of time spent in breeding ponds. Having entered the pond in early spring, adult newts may spend anything from one day to seven months or more in a pond. At one well monitored site a third of the population occupied the pond for less than ten days. Therefore, shortly after the main movement into ponds, there may be a period of emigration when newts leave to forage or disperse on land. Newts may also repeatedly move in and out of ponds, over the spring and summer.

At most sites, the majority of adult Great crested newts tend to stay within around 250m of the breeding pond[26]. However, newts may well travel further than this and small numbers of individuals are known to disperse as colonisers to distances of 1000m or more. Networks of ponds are crucial to

[24] UKBAP, 2009
[25] Langton *et al* (2001)
[26] Langton *et al* (2001)

the species and pond clusters are more successfully utilised by the species and allow movement of individuals between metapopulations.

Figure 7: Phase 6: Technical Method for Great Crested Newt

Step	Method
7.1	A 250m buffer was added to any identified standing water feature (Base Layer 2) and the Great crested newt species alert layers obtained from SEWBReC. This meant that still water features and species records had to be closer than 500m to be considered as connected and identified clusters of connected habitat features and species records. This forms the **Great Crested Newt (GCN) Existing Connectivity Layer** (Layer 9).
7.2	Another 250m buffer is added to the Great Crested Newt Existing Connectivity Map above and the overlap from these buffers was identified and saved. This highlights opportunities where the addition of a single pond and its 250m buffer, would lead to two or more existing buffer areas becoming connected. This forms the **Great Crested Newt (GCN) Opportunities to Extend Connectivity Layer** (Layer 10).

It is important to remember when viewing the results of this analysis that the Great Crested Newt Existing Connectivity Layer created above does not take habitat quality into account and we know that this is important for the species[27]. The layer simply highlights networks of ponds. These existing ponds may then be targeted for habitat improvement; this includes the habitat around and between ponds as well as the ponds themselves. Habitat improvement within the existing network is just as important as adding to and joining up the network through the generated Great Crested Newt Opportunities to Extend Connectivity Layer.

Dormouse

There has been a significant decline in numbers of this species throughout Britain in recent years. In Monmouthshire there is an important population of dormice, but it is widely scattered and occurs at a low density. Population decline is largely due to changes in habitat management but on top of this, habitat fragmentation can create isolated and non-viable populations.

This species' core habitat constitutes extensive ancient semi-natural woodland with a good shrub layer and anywhere hazel is coppiced on a long rotation. Some types of scrub, species-rich hedgerow and also young plantation or secondary woodland can also offer excellent conditions[28].

Dormice are largely arboreal, only coming down to the ground to hibernate, so need to be able to move about within woodlands through trees and bushes or move between woodlands using tall hedgerows. They are unwilling to move even short distances, possibly as little as 100m, over open ground. Such open

[27] Langton *et al* (2001)
[28] UKBAP, 2009

areas act as barriers and corridors of trees or bushes between sites are essential to allow the dispersal and mixing of populations.[29].

Figure 8: Phase 6: Technical Method for Dormouse

Step	Method
8.1	The Woodlands & Hedgerows Base Layer (Layer 3) was viewed in conjunction with the Dormouse species alert layer obtained from SEWBReC. Any woodland or hedgerow that had a dormouse record within it was highlighted along with all physically connected features. These highlighted features form the **Dormouse Existing Connectivity Layer** (Layer 11).
8.2	The remaining woodland and hedgerows, i.e. those without Dormouse records, were also saved as a layer. This **Dormouse Additional Potential Habitat Layer** (Layer 12) was viewed in conjunction with The Dormouse Existing Connectivity Layer. Any two features from these two layers that were within 205m of each other were identified using a buffer technique. A standard buffer of 102.5m was applied to all the features identified on the Dormouse Existing Connectivity Layer and any remaining features without Dormouse records. The use of a 102.5m buffer means that two features that are precisely 205m apart will have buffer boundaries that meet and any features closer than this distance will produce an overlap of the buffers. This method highlights areas of opportunity to link up habitat patches known to support Dormice with areas that have the potential to support the species.
8.3	Any regions of overlap between buffers created in Step 8.2 together with the woodland and hedgerows without Dormouse records were extracted to create the **Dormouse Opportunities to Extend Connectivity Layer** (Layer 13).

Again, it is it should be highlighted that the Dormouse Existing Connectivity Layer created above does not take habitat quality into account. Dormice need woodland with a good diversity of trees and shrubs to provide an all year round food supply and help the animals increase their body weight before hibernation. The layer simply highlights networks of potential habitat. These existing features may be targeted for habitat improvement. This enhancement within the existing network is just as important as adding to and joining up the network through the generated Dormouse Opportunities to Extend Connectivity Layer.

<u>Otter</u>

Having rapidly declined in the 1950s to 1970s, otter populations are now believed to be increasing in Wales. Monmouthshire is a stronghold for the species, with the otter population being one of the primary qualifying features for both the Usk and Wye SACs[30].

[29] Bright *et al* (2006)
[30] JNCC, 2009

Their core habitat is rivers and streams, but they frequently travel over land between watercourses regularly visiting ponds and lakes to feed – particularly those stocked with fish or with good numbers of breeding amphibians[31]. They make use of adjacent bank habitats such as natural hollows (holts) in dense woody scrub, beneath exposed root systems, within reed beds and amongst cavities of natural rock formations and man-made structures as secure lying up sites for daytime resting and shelter[32 & 33].

Otters usually occupy large home ranges. Linear ranges for mature males can reach over 40km and females may range 20km or more[34]. Individual otters may travel 20km or more in a single night. Road traffic accidents cause a significant number of otter casualties in Wales[35]. Some 65% of otter mortalities occur within 100m of a watercourse, and of these approximately 34% occur at bridges and 44% at culverts[36].

Figure 9: Phase 6: Technical Method for Otter

Step	Method
9.1	Using a copy of the Water Features Base Layer (Layer 2), other major water features outside the settlement buffer were added to create the **Otter Existing Connectivity Layer** (Layer 14). The outlying major watercourses such as canals and main rivers were added to reflect the wide ranging nature of the species.
9.2	Using a red box anywhere the watercourses pass under a road/bridge, or are culverted (where this can be determined from the information available, i.e. aerial photos) was highlighted as a constraint to otter movement and therefore a potential opportunity for enhancement/mitigation. This included any hotspots identified through road casualty records[37]. This forms the **Otter Opportunities to Enhance Connectivity Opportunities Layer** (Layer 15).

[31] JNCC, 2009
[32] O'Sullivan, 1993
[33] Harper, 1981
[34] Green *et al*., 1984
[35] Chadwick, 2009
[36] Grogan *et al.,* 2001
[37] Chadwick, 2009

5. Results

The methodology followed has identified both examples of existing connectivity and opportunities to improve connectivity, in relation to priority habitats and selected species within each of the thirteen settlements. The maps presented here display the regions of the settlements where these connections and opportunities exist.

5.1 Interpretation of the maps

Existing Habitat Connectivity Maps

The Existing Habitat Connectivity maps display primary routes of connectivity. These relate to physical linkages between semi-natural habitats and protected sites, in turn providing the potential for species movement within the settlement and between the settlement and the wider landscape.

Habitat Connectivity Opportunity Maps

The Habitat Connectivity Opportunity maps identify regions of the settlements where connections between semi-natural habitats could be made.

The habitat connectivity opportunities maps include areas where there are:

1) Opportunities to build connections between two parts of the existing routes of connectivity within a settlement.
Or
2) Opportunities to build connections between existing routes of connectivity and a currently physically unconnected selected semi-natural feature ('Additional Habitat Patch').

These regions represent theoretical opportunities; they give no consideration to features which may represent irresolvable barriers on the ground, for example built structures such as roads, buildings and central urban zones.

Species Existing Connectivity Maps

The species connectivity maps display examples of existing connectivity relating to the primary habitat for the dormouse, otter and great crested newt.

Species Connectivity Opportunity Maps

The species opportunity maps identify areas where connectivity of a species' primary habitat could be improved.

5.2 Settlement Reports

The methodology outlined in this report has identified both primary routes of existing connectivity, as well as opportunities to improve connectivity both in relation to priority habitats and selected species within each of the thirteen settlements.

Opportunities for enhancing habitat connectivity within the settlements can be thought of in a number of ways. Opportunities could include bolstering the size of the existing semi-natural resource, bridging gaps and where possible linking to more isolated semi-natural pockets.

Maintaining the quality of existing priority semi-natural habitats, whilst also increasing their overall density and improving linkage with other semi-natural habitats, in turn, supports robust and resilient ecological networks.

Both the Existing Habitat Connectivity Maps and Habitat Connectivity Opportunities Maps should be considered when examining connectivity opportunities within the settlements.

The reports below for each settlement provide a review of existing connectivity and opportunities for improving connectivity regards priority habitats and selected species in Monmouthshire.

Please note:
Final, good quality copies of the maps were printed out in-house by Monmouthshire County Council for insertion into the hard copies of this report. If you are accessing the electronic version of this report, better quality maps are available on request to Biodiversity & Ecology Officer, Countryside Service, MCC, County Hall, Cwmbran. NP44 2XH

5.2.1 Settlements 1-4: Caldicot, Portskewett, Rogiet & Sudbrook

Existing Habitat Connectivity within the settlement

The settlements of Caldicot, Portskewett, Rogiet and Sudbrook lie in such close vicinity that they were combined for the purposes of this assessment.

The villages of Caldicot, Portskewett, Rogiet and Sudbrook adjoin each other and are situated between Chepstow and Newport. Together they form an urbanised area which connects with the Caldicot Levels beside the Welsh shore of the Severn Estuary. The M48 motorway runs east-west along the north of the settlement and a main railway line runs east-west through the south of the settlement. The line splits just west of Portskewett with one of the subsequent lines running north through the settlement. The railway lines act to divide Portskewett and Sudbrook from Caldicot and Rogiet. The M4 motorway skirts the southern edge of the settlement and together with the linear features above encircle the main urban zones of Caldicot and Rogiet.

Whilst acting as a barrier to the movement of some wildlife across them, these interconnected major linear features represent a main route of connectivity through and out of the settlement.

The roads and railway support extensive semi-natural verges, much of which is lined with trees, scrub and rough grassland. The corridor widens in places, particularly alongside the railway, to include adjacent patches of woodland and scrub, and smaller areas of semi-improved species-rich grassland. The railway verges also connect with the reen networks of Rogiet and Caldicot Moors.

The Nedern Brook provides a further corridor and flows north-south through the settlement between Caldicot and Portskewett, and provides a connection between the M4 and railway corridors. In the north, it is adjoined by Nedern Brook Wetlands SSSI and further south by Caldicot Castle Country Park. Towards its southern limits, the brook's semi-natural corridor narrows as it travels through the Severn Bridge Industrial Estate and sections of it are culverted.

At the south of the settlement lie the Gwent Levels Magor and Undy SSSI: a site of national conservation importance. It connects with the settlement's main linear route of connectivity via the railway's verges. This SSSI is continuous with the Severn Estuary, a site of international conservation importance (with Ramsar[38], SAC and SSSI designations).

Within the main urban zones of the settlement, modern residences lie in close proximity to each other and areas of semi-natural habitat (as identified in this study) are limited.

Summary - Identified habitat connections include:

1) The linear network formed by the **semi-natural verges of the interconnected M48 motorway and railways**. This is enhanced by connections with adjacent small blocks of semi-natural habitat and reens.

2) The **Nedern Brook Wetlands SSSI**, and Nedern Brook flowing through the settlement and into the River Severn at Caldicot Pill, which connects with 1) above.

3) The **Gwent Levels Magor and Undy SSSI** which lies at the south of the settlement and interlinks with 1) above.

4) The **ASNW woodland of Bushy Close SSSI** and adjacent woodland.

5) **Woodland and ponds off Dewstow Road** (north of settlement)

[38] Ramsar sites are designated under the International Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention).

6) **Hedgerows** line some of the field margins which are located near to the edges of the settlement. Hedgerow extent and connectivity appears lower than in some other settlements. In addition compared with other settlements few hedgerows are apparent in the main residential area of the settlement, where residences are positioned in close proximity to each other. However the hedgerows offer some local connectivity for example between the blocks of ASNW SINCs around Portskewett Hill. In the north west of the settlement hedgerows provide connections between the M48 corridor and ASNW woodlands and grassland SINCs near Ifton.

Connectivity with the wider landscape

Most significantly, the settlements join the Gwent Levels SSSI, an extensive system of reens and wetland habitat of national conservation importance. Furthermore, this links with the wide reaching Severn Estuary, a site of international conservation importance (SSSI, SAC and Ramsar designations). To the north lies a series of Planted Ancient Woodland Sites (PAWS) (centred on Great Ifton Wood), Nedern Brook Wetlands SSSI and Brockwell's Meadows SSSI. Local Protected Sites also feature, with a series of grassland SINCs. These include Lower Minnets grassland SINC and the grassland SINCs of Five Lanes. 2.5km north from the settlement lies the MOD Caerwent site together with a network of PAWS and the SSSI grasslands of Dinham Meadows. PAWs units stretch eastwards from here forming a series of stepping stones towards Chepstow. Many of the species-rich grasslands are calcareous in nature, the locality of Caerwent supporting a concentration of calcareous grasslands which are rare within the rest of Monmouthshire where neutral grassland types persist.

Circa 6km to the north west of the settlement are the large PAWS of Wentwood and a concentration of grassland SINCs around Shirenewton. Directly to the west lie the settlements of Magor and Undy.

Opportunities to strengthen existing connectivity

Strengthen the existing primary route of connectivity and overcome barriers.

1) Strengthen the railway and motorway corridors: ensure tree lines and hedgerows are well connected and sensitively managed. Ensure sensitive management of grassland verges.

2) Strengthen the Nedern Brook corridor, the main semi-natural corridor through the urban zone of the settlement. Ensure a buffer of semi-natural habitat with adjacent fields and the built urban landscape and connect with nearby areas of semi-natural habitat where possible. Some sections are culverted/pass beneath roads. This will present a barrier to the movement of some wildlife. Exploration of how significant a barrier it represents, in order to help inform the need for a possible resolution may be of value.

3) Ensure hedgerows are sensitively managed and well-connected.

4) Ensure current blocks of semi-natural habitat and protected sites are sensitively managed and their extent increased where appropriate. Ensure ditches are sensitively managed.

Opportunities to enhance connectivity

An opportunity is identified to enhance connectivity between the block of woodland and ponds, off Dewstow Road (north-west part of the settlement) and the M48 road verge corridor to its south. This represents an opportunity to enhance connectivity between different sections of the main route of connectivity.

A series of other opportunities are highlighted for building connections amongst additional habitat patches (woodland and small groups of trees/scrub) and between them and the main route of connectivity. These additional habitat patches are mainly distributed across the northern half of the settlement. Patches vary in size. Most significant in terms of conservation status and habitat size are the clusters of ASNW SINCs centred on Portskewett Hill. Opportunities are highlighted to link these patches to each other and to the railway corridor (to the south) and Bushy Close SSSI and adjacent Withy Bed woodland (to the east).

To the east of Rogiet, opportunities are highlighted to enhance connections between a series of small groups of trees stretching north-south between the M48 and railway corridors.

Further opportunities are highlighted to link patches of trees adjacent to the Nedern Brook corridor, north of Caldicot Castle.

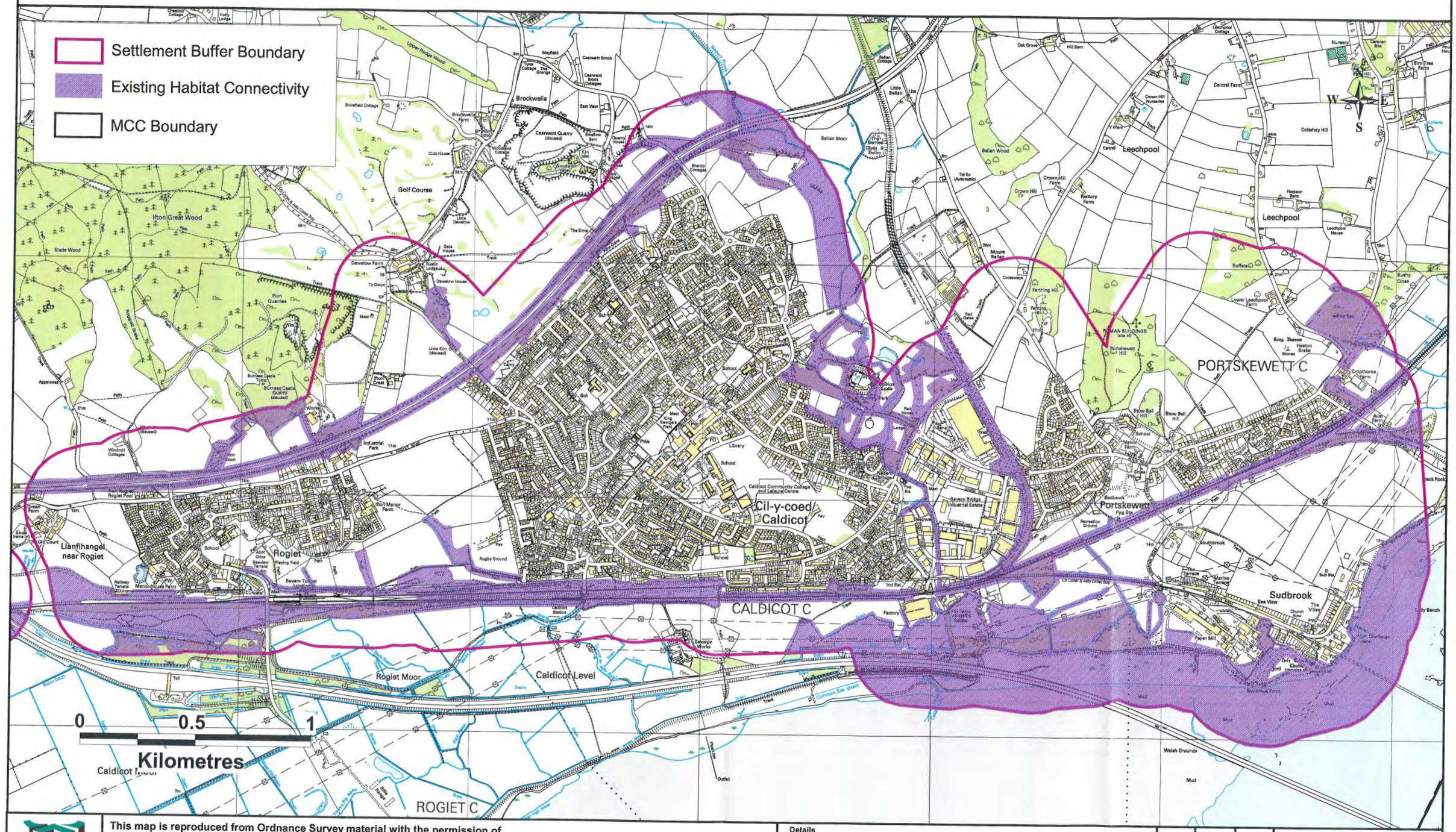
Great Crested Newts and Ponds

Ponds identified in this study are mainly situated towards the edges of the settlement boundary. The largest cluster of connected ponds within the settlement boundary is situated to the south of Rogiet and straddles the south west part of the boundary. Opportunities are identified to link this cluster with two further ponds to the east.

In the north there is an opportunity to link a pond cluster near Dewstow Road with a group of ponds to the north of Ifton quarries, as well as to link to a further pond near Brockwells.

Other opportunities are to link ponds at the north edge of the settlement with further ponds beyond the boundary and also to link with an isolated pond (centred on Caldicot).

Caldicot, Portskewett, Rogiet & Sudbrook: Habitat Connectivity Map



Details: Caldicot, Portskewett, Rogiet & Sudbrook: Settlement 1-4		
Drawn By: Fry.D	Scale: 1:16000	Date: 16/04/2010
Ecological Connectivity Assessment of Settlements in Monmouthshire		

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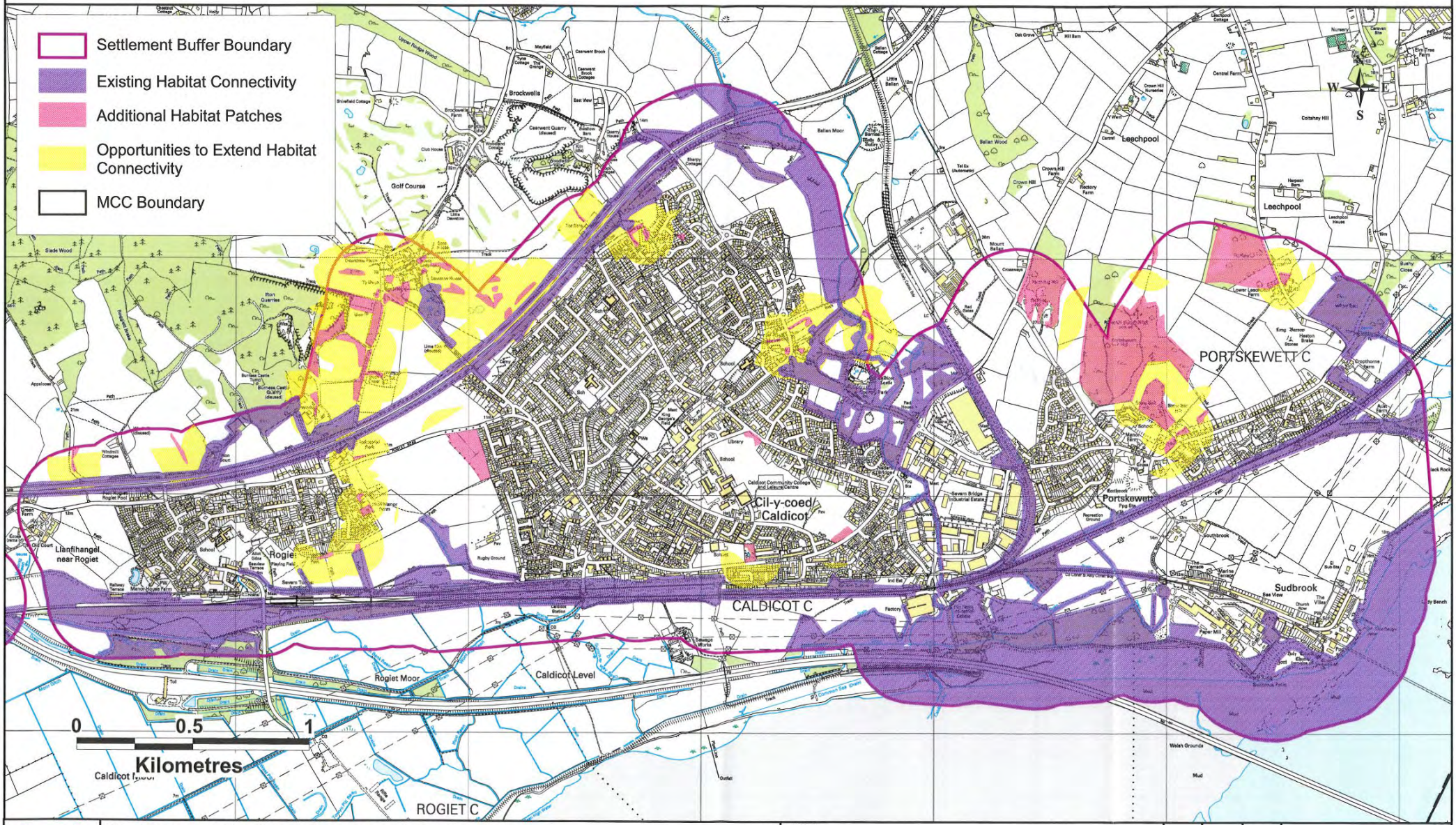
Caldicot, Portskewett, Rogiet & Sudbrook: Habitat Connectivity Opportunities Map



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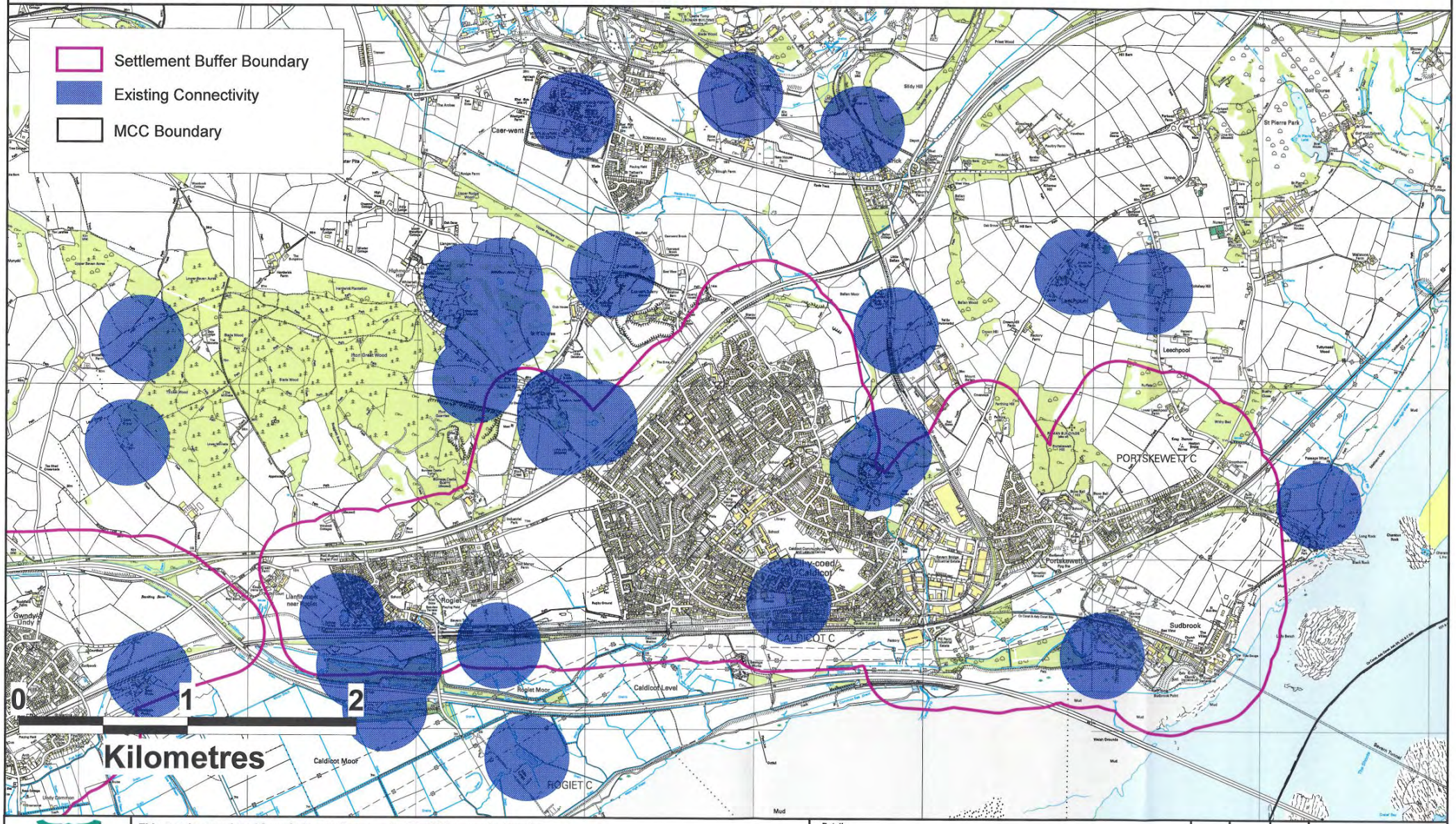
Caldicot, Portskewett, Rogiet & Sudbrook: Great Crested Newt & Ponds Connectivity Map



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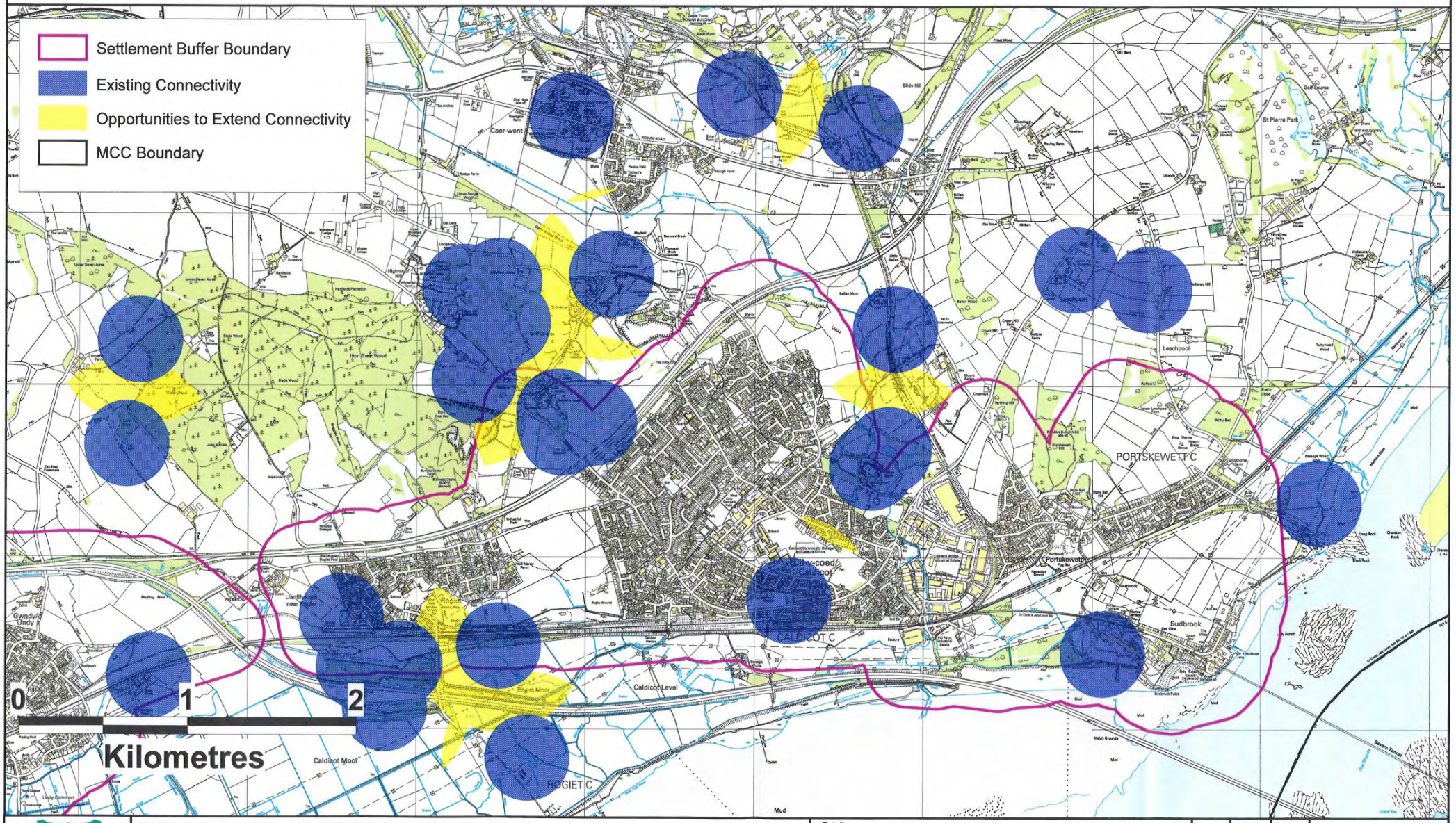
Caldicot, Portskewett, Rogiet & Sudbrook: Great Crested Newt & Ponds Connectivity Opportunities Map



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5.2.2 Settlements 5-6: Magor & Undy

Existing habitat connectivity within the settlement

The settlements of Magor and Undy lie in such close vicinity that they were combined for the purposes of this assessment.

The villages of Magor and Undy are situated between Chepstow and Newport. Together they adjoin the Gwent Levels beside the Welsh shore of the Severn Estuary. The major road artery of the M4 motorway runs east-west through the northern half of the settlement. This splits into two near the eastern limit of the settlement; with the M48 travelling eastwards and the M4 dropping south towards the new Severn Bridge. A main railway line runs east-west through the settlement's southern half. Furthermore, the B4245 runs south from the M4 past Magor Brewery in the west of the settlement. Together these linear features encircle the main urban zone of Magor and Undy. Whilst acting as a barrier to the movement of some wildlife across them, these interconnected major linear features represent a main route of connectivity through and out of the settlement.

A further corridor is St Bride's Brook / Mill Reen which passes north-south though the settlement between Magor and Undy. At the north, it runs through a block of semi-improved species-rich grassland and woodland. However, moving south through the settlement, its adjacent semi-natural buffer becomes narrow.

The roads and railway support extensive verges, much of which is lined with trees, scrub and rough grassland. Some contain sections of ditch. The corridor widens in places, especially along the M4 to include adjacent patches of woodland and semi-improved species-rich grassland.

The northern part of the Gwent Levels Magor and Undy SSSI stretches along the southern limits of the settlement and abuts the railway line. The Gwent Levels are an extensive wetland site of national conservation importance and adjoin the internationally important Severn Estuary (SSSI, SAC and Ramsar).

The Gwent Levels area includes GWT's Magor Marsh Reserve and Bridewell Common Field grassland SINC. Upper Grange Farm grassland SINC lies near the northern boundary of the settlement.

Within the main urban zones of the settlement, modern residences lie in close proximity to each other and semi-natural habitat is reduced. Within this urban zone St. Brides Brook / Mill Reen, an area of woodland and semi improved grassland (Rockfield Farm) and an isolated band of woodland (to the west of Vinegar Hill) represent the main examples of semi natural habitat.

Summary - Identified habitat connections include:

1) The linear network formed by the semi-natural verges of the interconnected **M4/M48 Motorway and railway** form the main route of connectivity. This further connects with St Bride's Brook / Mill Reen and verges of the B4245 road running past the Magor Brewery. This corridor widens in places to include adjacent patches of semi-improved species-rich grassland and woodland.

2) **Gwent Levels Magor and Undy SSSI** is the largest protected site within the settlement and links with 1) above. Reens enclose the fields, providing both local connectivity as well as connectivity into the wider landscape through linkage with more major reens such as Mill Reen and Whitewall Reen.

3) **Hedgerows** enclose many of the agricultural fields of the north, east and west of the settlement and intersect at a number of points with the road and railway corridors, thereby providing both local field connectivity and augmenting the primary route of connectivity. The hedgerows also provide linkage with hedgerow networks beyond the settlement boundary and in turn provide connections between the settlement and blocks of semi-natural habitat in the wider landscape, for example hedgerows provide linkage between patches of woodland around Knollbury (to the settlements north) and the verges of the M48.

4) A small **block of semi-improved grassland and woodland** at Rockfield Farm, Undy.

Connectivity with the wider landscape

Most significantly, Magor and Undy join the Gwent Levels SSSI, an extensive system of reens and wetland habitat of national conservation importance. Furthermore, this links with the wide reaching Severn Estuary a site of international conservation importance (SSSI, SAC and Ramsar designations).

Less than 1km to the north lies a series of PAWS and ASNW units including Penhow Woodlands SSSI, woodland SINCs and scattered grassland SINCs. Many of these species-rich grasslands are calcareous in nature, the locality of Caerwent supporting a concentration of calcareous grasslands which are rare within the rest of Monmouthshire where neutral grassland types persist.

Beyond this (and c.6km from the settlement) is the large PAWS of Wentwood and a concentration of grassland SINCs around Shirenewton. Directly to the east of Magor and Undy lie the combined settlements of Caldicot, Portskewett, Rogiet & Sudbrook.

Opportunities to strengthen existing connectivity

Strengthen the existing primary route of connectivity and overcome barriers.

1) Strengthen the railway and motorway corridors: ensure tree lines and hedgerows are well connected and sensitively managed. Ensure sensitive management of grassland verges.

2) Strengthen the St Bride's Brook / Mill Reen corridor, the main semi-natural corridor through the urban zone of Magor and Undy. Ensure a buffer of semi-natural habitat with adjacent fields and the built urban landscape and connect with near-by areas of semi-natural habitat where possible. Some sections are culverted/pass beneath roads. This will present a barrier to the movement of some wildlife. Exploration of how significant a barrier it represents, in order to help inform the need for a possible resolution may be of value.

3) Ensure hedgerows are sensitively managed and well-connected.

4) Ensure current blocks of semi-natural habitat and protected sites are sensitively managed and their extent increased where appropriate. Ensure ditches are sensitively managed.

Opportunities to enhance connectivity

Opportunities to enhance habitat connectivity between different sections of the primary route of connectivity are identified as linking Upper Grange grassland SINC (near Beeches Caravan Park) to the St Brides Brook to its west, and linking the woodland/semi-improved grassland by Rockfield Farm to the M48 verge corridor to its north, as well as to additional habitat patches (trees/scrub) by Vinegar Hill Farm to its south west.

A series of other opportunities are identified to enhance connections between the primary route of connectivity and additional habitat patches. These habitat patches are predominantly distributed in and around the main urban zones of Magor and Undy. Of particular significance are the opportunities to link the woodland blocks near Vinegar Hill (the largest blocks of semi-natural habitat within the residential part of the settlement) to each other and to the primary route of connectivity via a connection to woodland to the north, St Bride's Brook / Mill Reen to the west, and railway to the south.

In the vicinity of Magor Brewery opportunities are highlighted to enhance local connections between small groups of trees/scrub on site, as well as linking them to the main route of connectivity, i.e. the B4245 corridor to the east and woodland strip to the west.

Otters and Watercourses

The Gwent Levels – Magor and Undy SSSI is situated at the southern edge of the settlements. The component ditch network represents the main watercourses within Magor and Undy. These reens link with the extensive reen network of the wider Gwent Levels which are know to be used by otters (which are a are a qualifying feature for its designation as a SSSI), as well as the Severn Estuary. St Bride's Brook / Mill Reen is the only watercourse

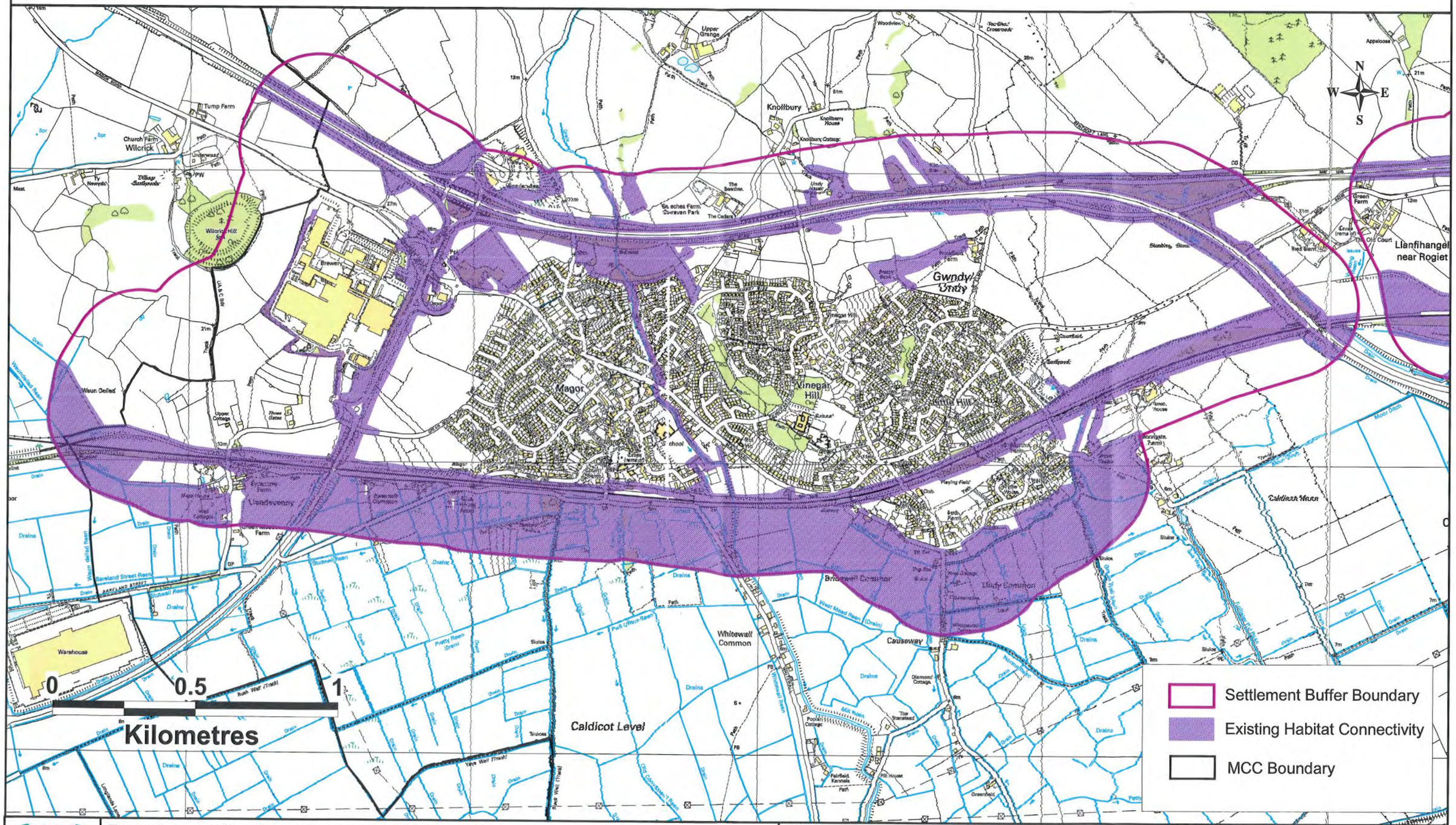
flowing north-south through the settlement. It is likely this is used by otters as a migration route to the Gwent Levels.

Otters are known to face a number of potential threats and barriers to movement and within the UK landscape. This includes accidental deaths primarily from road and railway crossings. Such incidents are likely to increase where otter populations are recovering and where traffic flow is high. Otters can also face increased disturbance due to escalating public access and the impact of development in floodplains.

Culverted sections of the St Brides Brook/Mill Reen present the main physical barriers to the potential movement of otters along the settlement's watercourses. For example the watercourse intersects with both the railway and the M48 as it flows south through the settlement. The narrow semi-natural brook corridor and resulting close proximity to the main urban zone of the settlement may also present disturbance issues for otters in the area.

Further barriers include other potential otter road and railway crossing points in the south of the settlement, where otters may need to negotiate roads to move amongst the network of reens.

Magor & Undy: Habitat Connectivity Map



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Fry.D	1:13000	16/04/2010	
Ecological Connectivity Assessment of Settlements in Monmouthshire			

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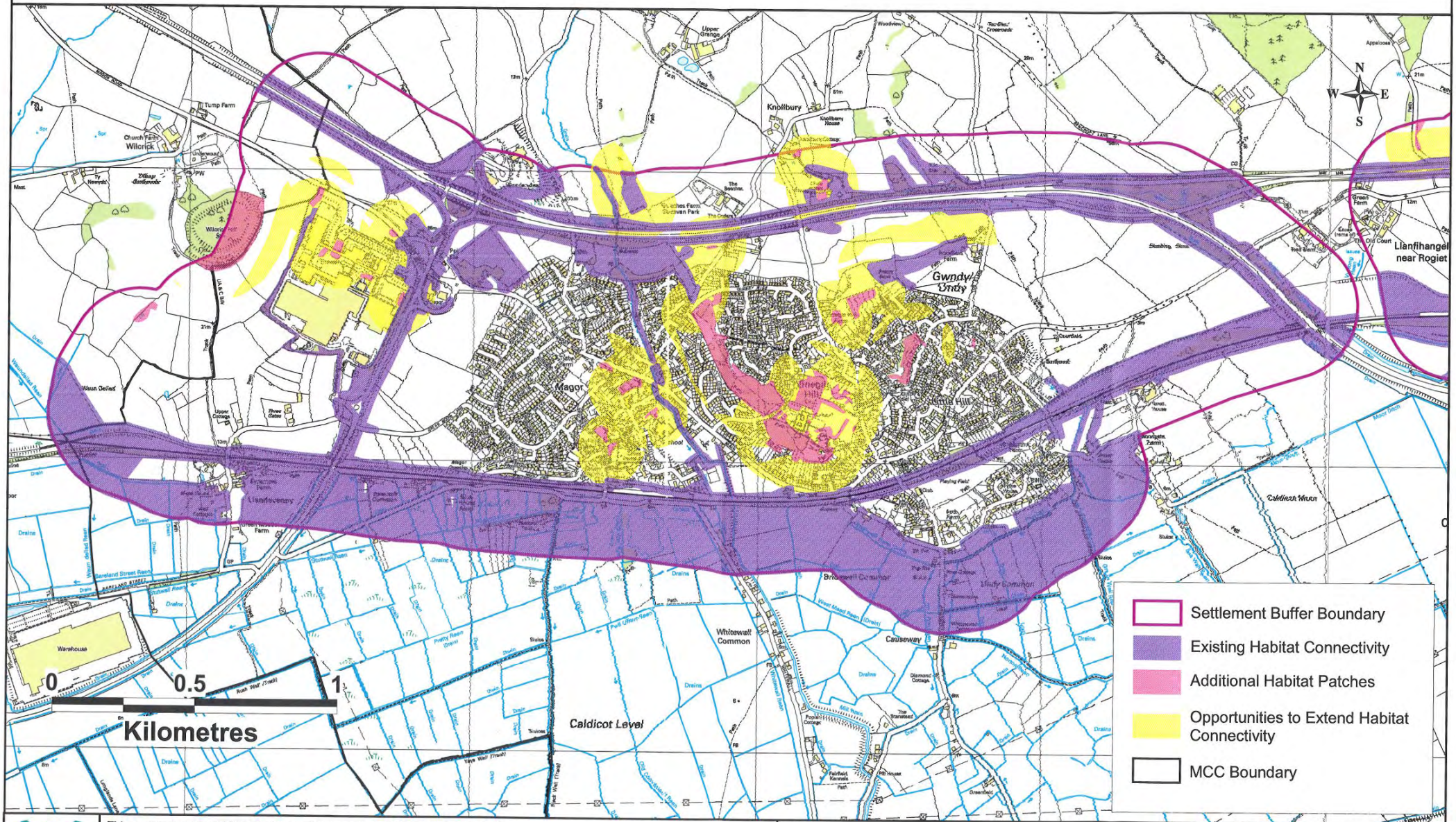
Magor & Undy: Habitat Connectivity Opportunities Map



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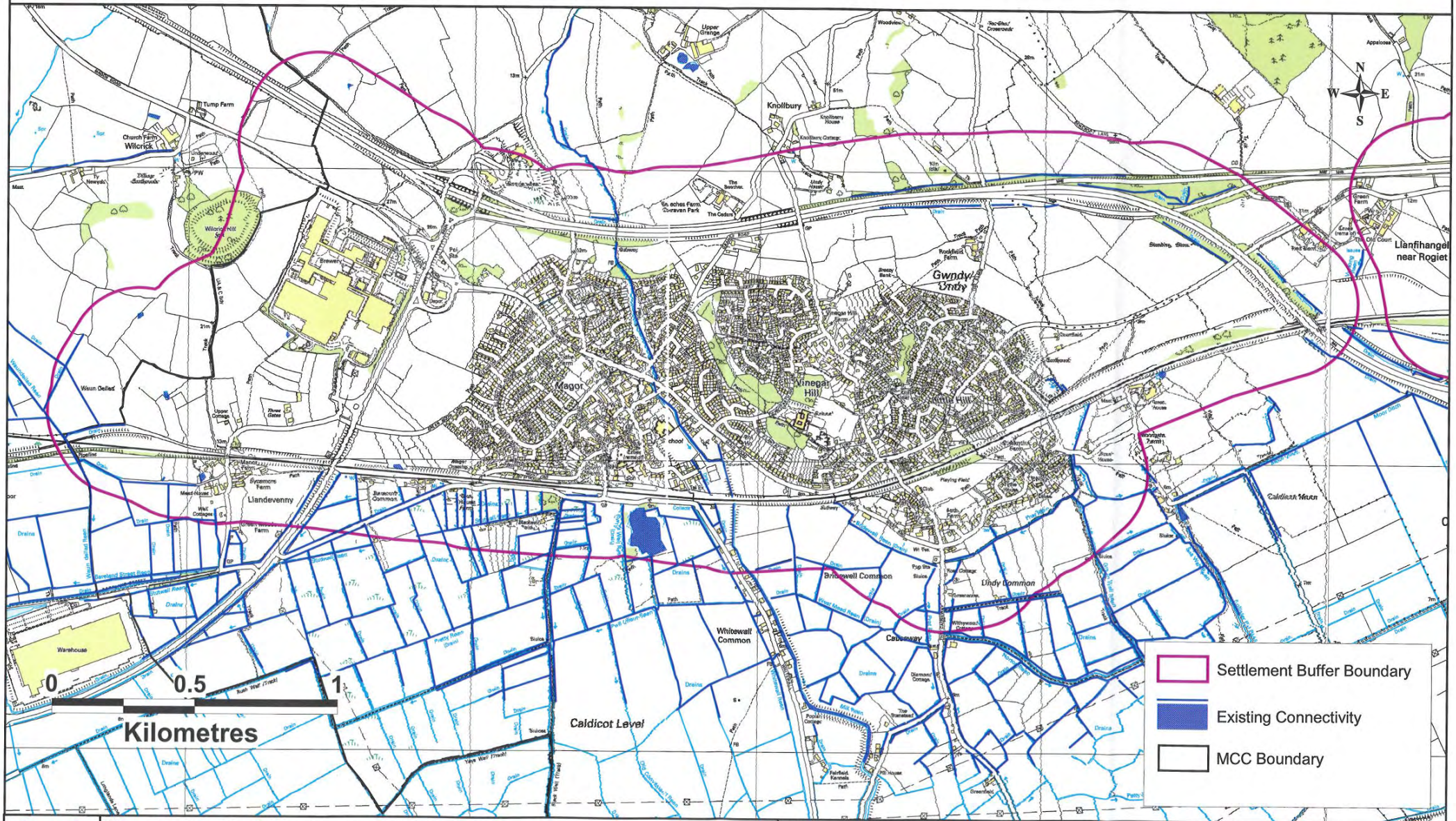
Magor & Undy: Otters & Watercourses Connectivity Map



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Ecological Connectivity Assessment of Settlements in Monmouthshire			

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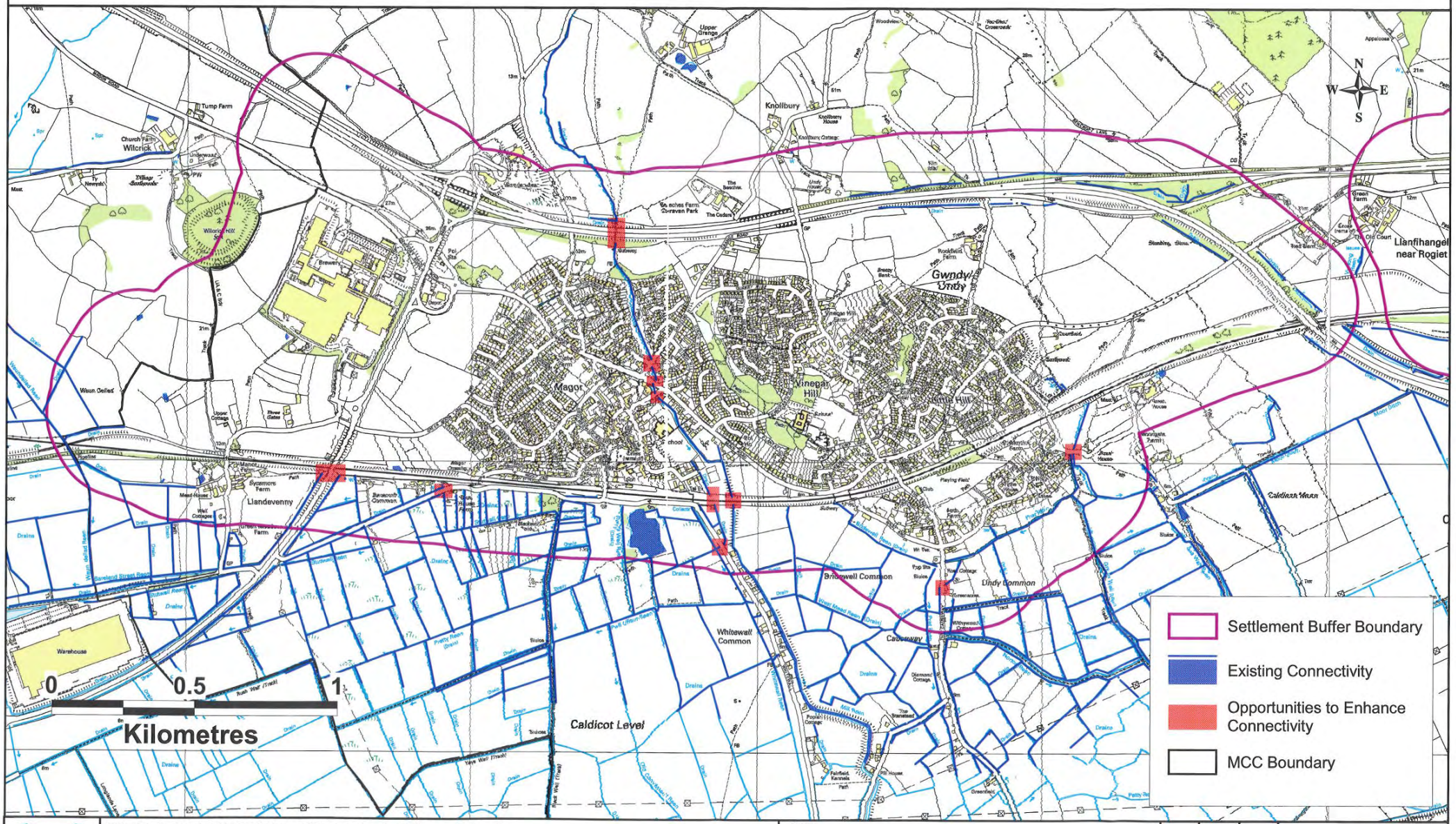
Magor & Undy: Otters & Watercourses Connectivity Opportunities Map



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Drawn By	Scale	Date	
Fry.D	1:13000	16/04/2010	
Ecological Connectivity Assessment of Settlements in Monmothshire			

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5.2.3 Settlement 7: Chepstow

Existing habitat connectivity within the settlement

Chepstow town's position in Monmouthshire adjoins the border with Gloucestershire, England. It is located on the River Wye, close to its confluence with the River Severn and the wider River Severn Estuary, and close to the western end of the Severn Bridge on the M48 motorway.

Chepstow is situated at the junction between two semi-natural areas of significant conservation interest and importance and far reaching physical influence. The lower reaches of the River Wye flows in and out of the settlement along the length of its eastern edge. The River Wye, a European Protected site (SSSI and SAC), joins with the River Severn, a site of international importance, receiving SSSI and SAC designations and being a Ramsar site. The River Wye and its associated woodlands are a major landscape and semi-natural feature.

The M48 motorway crosses east-west through the south end of the settlement, with the interconnecting A466 running north-south through the centre of the settlement and being a dual carriageway along its southern half. A mainline railway runs south near the eastern edge of the settlement. The settlement's major urban zone is focused to the east of the A466 and south of the Chepstow racecourse which lies in the north of the settlement. Furthermore the mainline railway from Wales to England runs though Chepstow.

Away from the River Wye itself, the most significant semi-natural features are concentrated at the margins of the settlement. Here the ASNWs of the Wye Valley pass into the settlement boundary: SSSI ASNW lie at the east and ASNW lies to the west. Other woodlands connect and extend out from these into the settlement. Elsewhere in the central part of the settlement, well-connected semi-natural features are rather infrequent. Three current grassland SINCs (Wyncliffe Wood Meadow, Chepstow Racecourse and Parc Penterry Meadow) are present, distributed through the northern half of the settlement.

Primary routes of connectivity within Chepstow are represented by linear features. The River Wye and its woodlands, the verges of the M48 motorway and dual carriageway and railway connect to form the settlement's most extensive corridor which is centred in its eastern and southern regions. The settlement is also flanked by ASNW woodland and semi-improved grassland along parts of its western boundary. This is nominally connected across the north of the settlement to the habitats of the River Wye and its woodland, so further increasing the extent of the primary route of connectivity.

Summary – Identified habitat connections include:

1) **The River Wye & Wye Valley Woodlands**. The River corridor is flanked in the north by ASNW woodland which forms part of the extensive Wye Valley SSSI woodlands, including Pierce Wood. This is fringed in places by further woodland. The Alcove Wood in particular means this corridor penetrates into the centre of the northern half of the settlement. Moving south, the River Wye corridor becomes less wooded, particularly as the river passes through the centre of Chepstow, and the distance between the river and the adjacent built environment declines. Areas of open grassland adjoin the Wye as it approaches the River Severn.

In the north the corridor is further extended by Penterry Parc grassland SINC and Wyndcliffe Wood grassland SINC

2) **Railway**. The railway crosses the River Wye and enters the settlement near Buffer Wharf and runs south near the eastern edge of the settlement. For much of its length, it runs in close parallel to the River Wye and so enhances the influence of the corridor in 1) above.

3) **M48 Motorway/A466 dual carriageway**. The extensive motorway verges provide a major linear corridor across the southern end of the settlement and intersecting with the A466 section of dual carriageway and the railway above.

4) **A cluster of ASNW** centred on Cockshoot Wood straddles the western settlement boundary and connects with a block of semi-improved species-rich grassland. A further block of woodland and semi-improved grassland lies alongside the western settlement edge to the north of Pwllmeyric.

5) **Hedgerows** line many of the settlement's fields (which are located mainly along the western side of the settlement). However condition appears variable and some appear gappy and defunct as stockproof boundaries. The hedgerows provide local connectivity amongst field units as well as intersecting with the features above thereby increasing overall ecological connectivity.

In addition hedgerows provide links to hedgerow networks and blocks of semi-natural habitat outside the settlement. For example hedgerows to the west of Bayfield show some connectivity with Great Barnets Wood and the Mounton Brook corridor.

The features above are interconnected and form a significant route of ecological connectivity within Chepstow.

<u>Connectivity with the wider landscape</u>

Chepstow is situated in close vicinity to the River Wye and its wooded valley. Winding in and out of the settlement, the River Wye connects Chepstow to an ecological network of huge physical influence and of European conservation significance; the River Wye, its gorge, cliff habitats and associated Wye Valley Woodlands receive protection as a SAC and SSSI. In particular, permeating

the east of the settlement, these woods include Pierce Wood and Piercefield Cliffs. Furthermore, the Wye flows into the River Severn and its estuary which is of international conservation importance (SSSI, SAC and Ramsar designations).

The woodlands of the lower Wye Valley form one of the most important areas for woodland conservation in Britain, comparable with the Caledonian pinewoods, the oceanic oakwoods of Western Britain, the New Forest and the mixed coppices of East Anglia. Semi-natural woodland is abundant and virtually continuous along the gorge. Most woods are a rich mixture of stand types which are believed to be similar in composition to the original natural woods, of the valley. Many rare and local species are present, including some of the rarest native tree species, for example large-leaved lime (*Tilia platyphyllos)*, whitebeams (*Sorbus* spp.) and trees close to the edge of their European range, for example hornbeam (*Carpinus betulus)* and beech (*Fagus sylvatica)*. Furthermore these woods sit in a matrix of unimproved grassland and other semi-natural habitats which, together with the woods, make the Wye Valley one of the most diverse, species-rich and attractive areas in southern Britain.

The M48 motorway and railway provide further wide reaching links between the settlement and the wider landscape. The settlement is further enclosed at the north and west by a series of ASNW and the clusters of grassland SINCs and SSSIs in and around Tintern, Whitelye, Devauden and Shirenewton.

The broadleaved woodland network of the lower Wye Valley is highlighted as an extensive network within CCW's core and focal networks ecological connectivity study[39]

Opportunities to strengthen existing connectivity

Strengthen the existing primary route of connectivity and overcome barriers.

1) Strengthen the major River Wye corridor the most extensive semi-natural corridor adjacent to the settlement. Ensure a buffer of semi-natural habitat with adjacent fields and the built urban landscape and connect with near-by areas of semi-natural habitat where possible.

2) Strengthen the railway and motorway corridors: ensure tree lines and hedgerows are well connected and sensitively managed. Ensure sensitive management of grassland verges.

3) Ensure hedgerows are sensitively managed and well-connected.

4) Ensure current blocks of semi-natural habitat and protected sites are sensitively managed and their extent increased where appropriate. Ensure ditches are sensitively managed.

[39] Latham *et al*

Opportunities to enhance connectivity

Additional habitat patches are frequent within the settlement, albeit largely away from the main residential areas of Chepstow. Many of these patches are distributed as clusters, and frequent opportunities to enhance connectivity between the habitat patches are identified. In turn numerous opportunities to connect these patches to and so extend the main route of connectivity are also highlighted.

For example small discrete groups of trees/woodland are scattered in and around Hardwick. Opportunities are identified to enhance connectivity between these individual patches, as well as to Parc Penterry grassland SINC to the north-west and Beaufort Quarry wood to the south east, thereby forging a link between these two currently discrete parts of the primary route of connectivity.

The opportunity to enhance connectivity between Parc Penterry SINC and Cockshoot Wood ASNW/semi-improved grassland to its north west is also identified, via enhanced connectivity with a strip of additional habitat patches (semi-improved grassland and trees) located mid way between the two main habitat blocks. There is a further opportunity to enhance connectivity between Cockshoot wood ASNW and Fryth wood ASNW to its north.

Within the north of the settlement opportunities are present to link Chepstow Racecourse grassland SINC to additional patches of semi-improved grassland to the east and west, and beyond to the main route of connectivity (River Wye woodland corridor at the east and Fryth wood ASNW at the west). These woodland and grassland habitats may already, by their close proximity to the River Wye corridor, act as stepping stones for species movement between the two sides of the settlement.

Opportunities to improve links between groups of trees/woodland patches near the outskirts of Chepstow town, and the railway and River corridor are also highlighted.

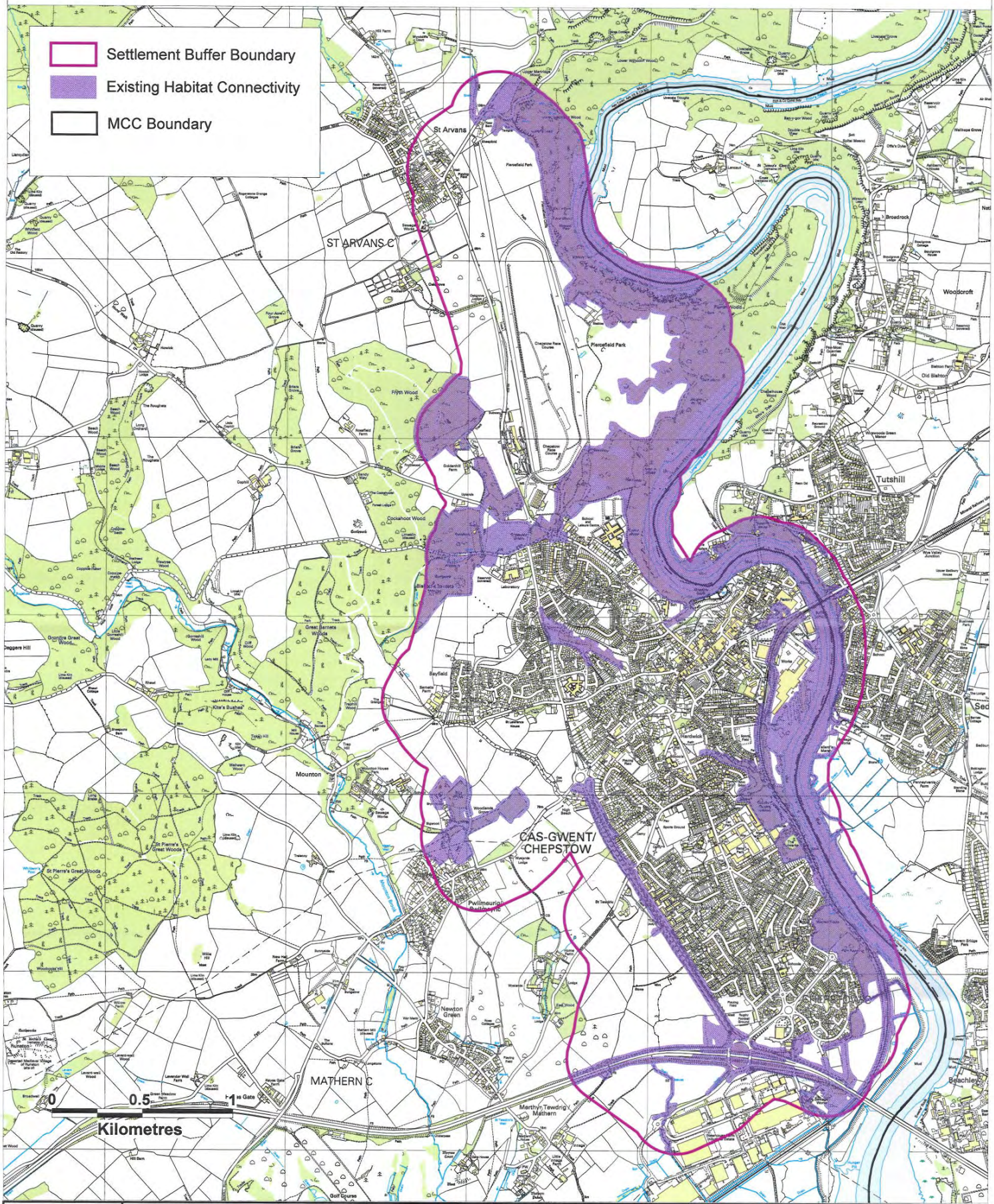
Dormice and Woodlands/Hedgerows

Hedgerows and woodlands connected to known dormouse records are identified in the east (Wye Valley Woodlands ASNW SSSI) and the west (ASNW units including Cockshoot Wood SINC) of the settlement.

Opportunities are identified to connect the two discrete areas above through the settlement, across the A466 near Chepstow Racecourse.

Other opportunities are identified to connect these woodlands and linked hedgerows to additional potential habitat for dormice to the south, i.e. forging links with hedgerows along the edge of the main urban zone of Chepstow. For example one potential opportunity example could be strengthening hedgerow/tree line connectivity along the edges of the A466.

Chepstow: Habitat Connectivity Map



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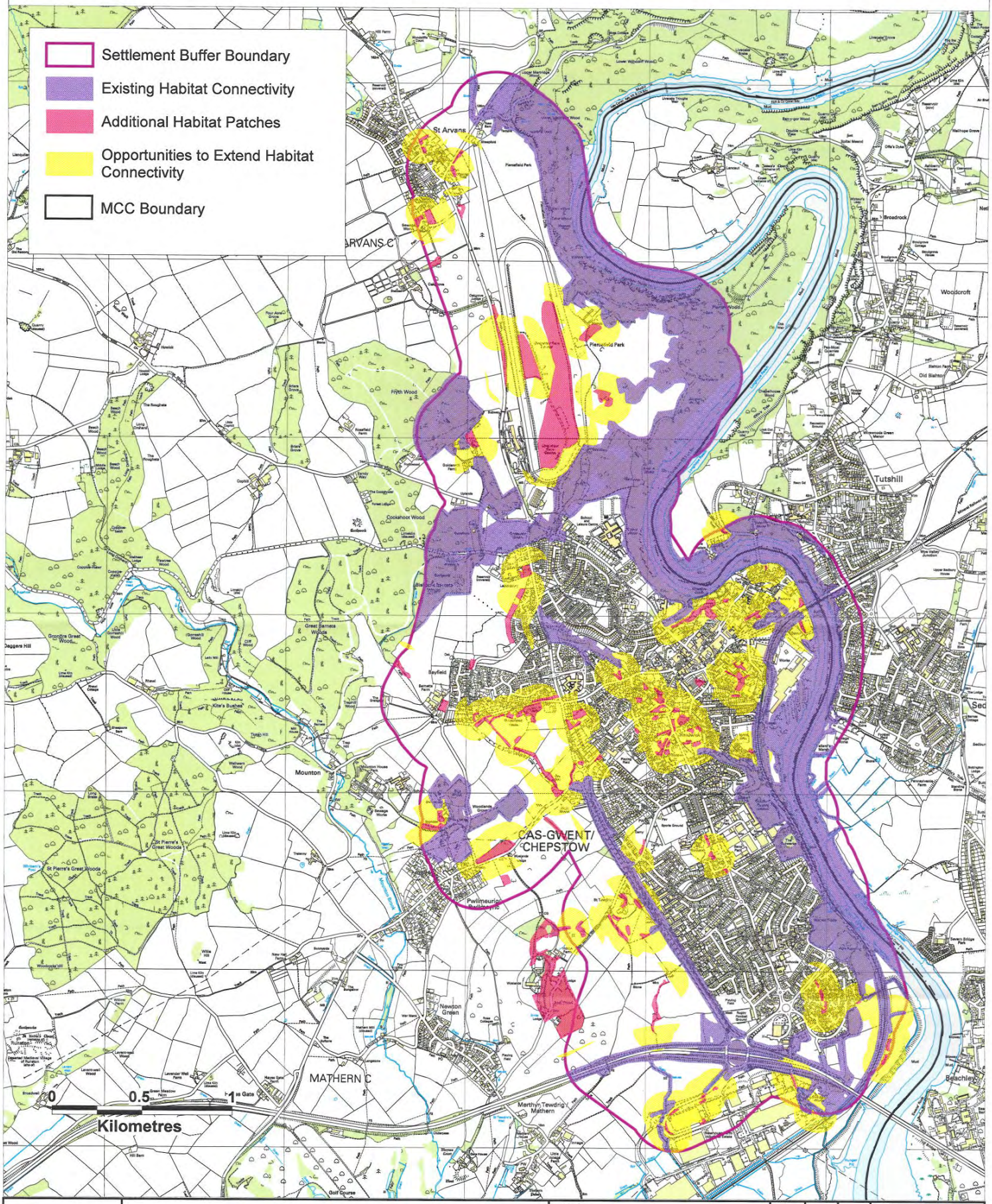
Drawn By Fry.D	Scale 1:20000	Date 23/04/2010				
Ecological Connectivity Assessment of Settlement in Monmouthshire						

Chepstow: Habitat Connectivity Opportunities Map



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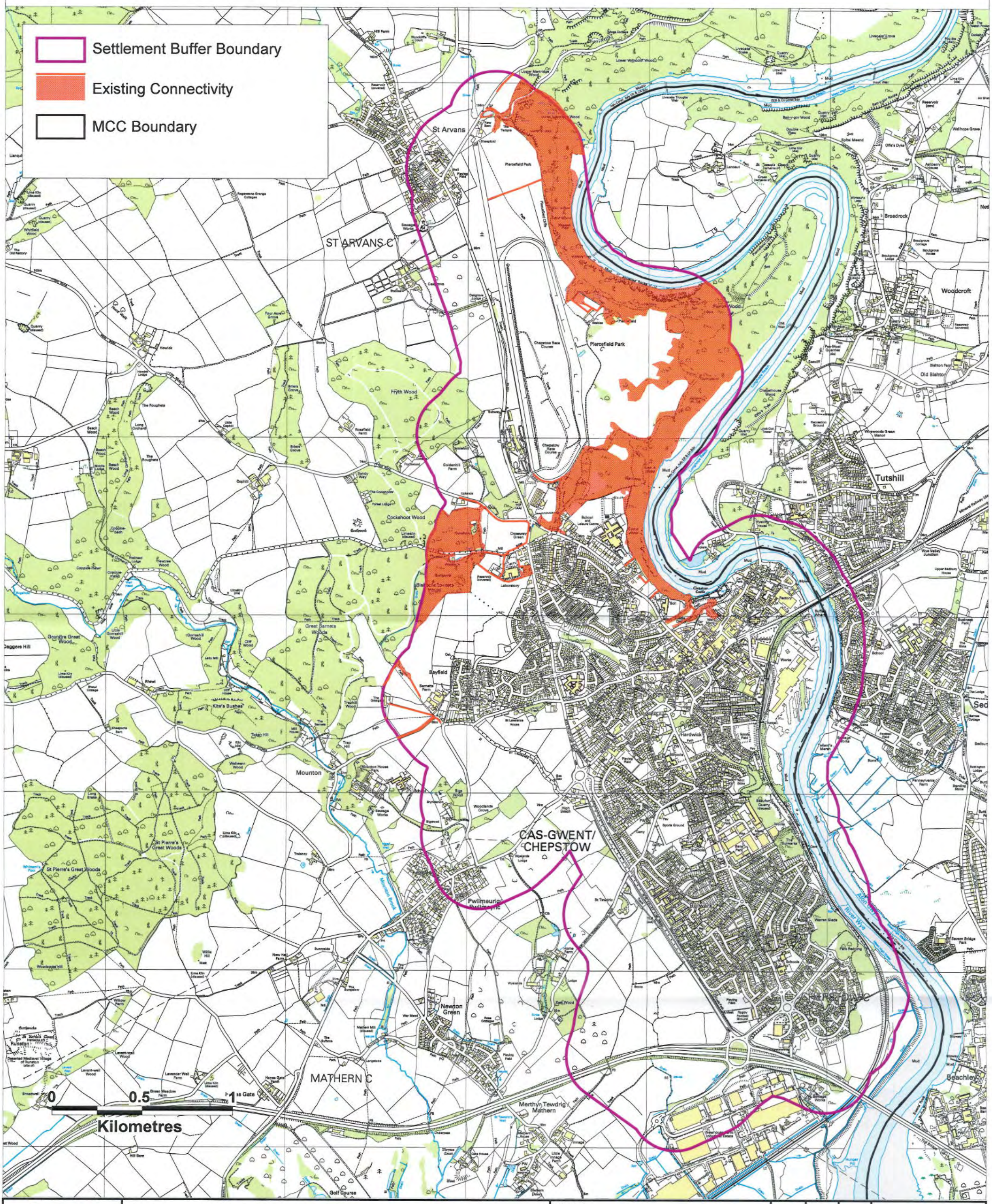
Ecological Connectivity Assessment of Settlement in Monmouthshire						

Chepstow: Dormouse, Woodlands & Hedgerows Connectivity Map



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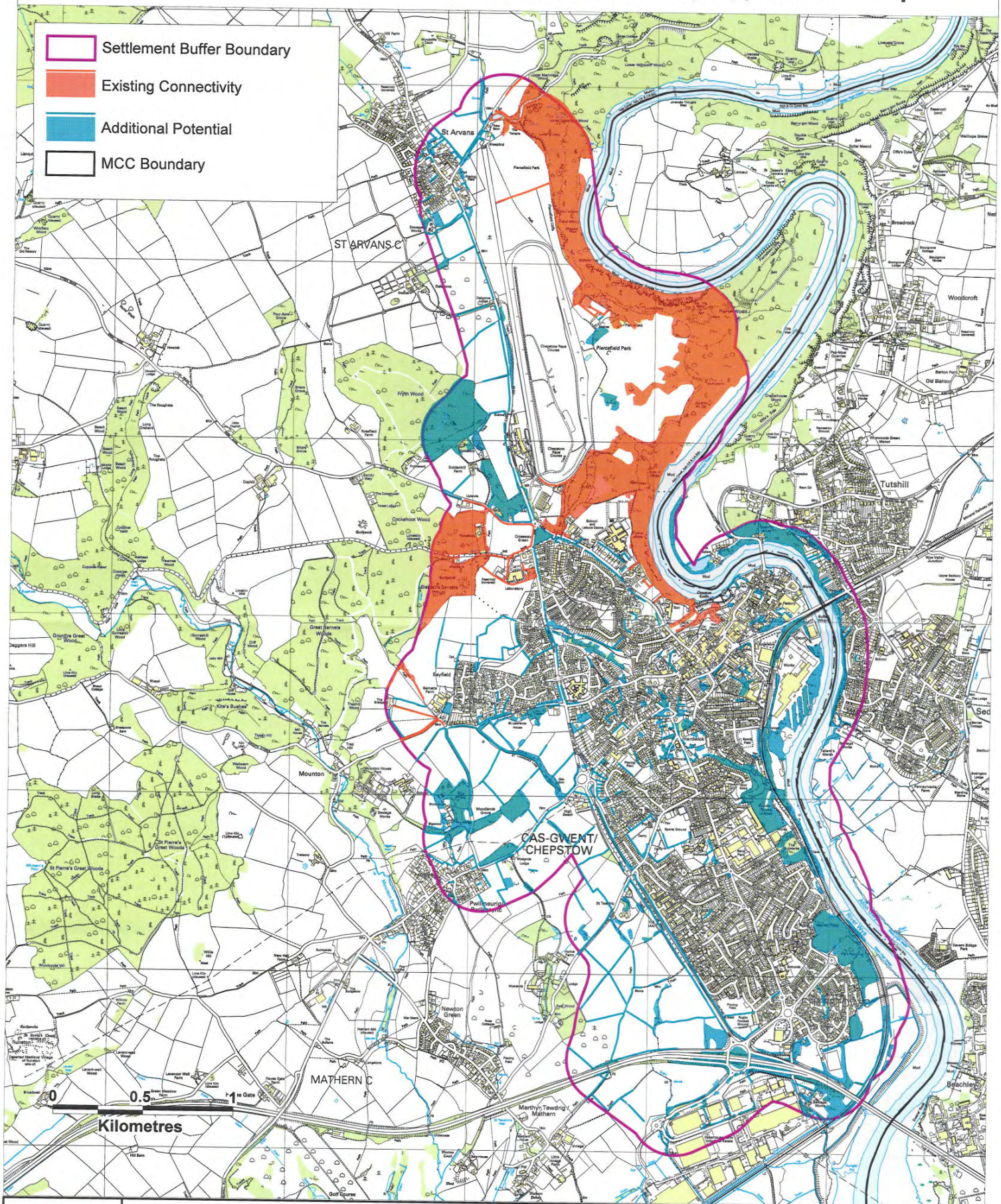
Ecological Connectivity Assessment of Settlement in Monmouthshire						

Chepstow: Dormouse, Woodlands & Hedgerows Connectivity Opportunities Map



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Drawn By Fry.D	Scale 1:20000	Date 23/04/2010
Ecological Connectivity Assessment of Settlement in Monmouthshire		

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5.2.4 Settlement 8: Monmouth

Existing Habitat Connectivity within the settlement

Monmouth is situated in the eastern part of Monmouthshire, close to the border with England and is the traditional county town of the historic county of Monmouthshire.

The town is centred on two major watercourses: the River Monnow flows north to south through the central part of the settlement, connecting with the River Wye (which flows north to south through the eastern part of the settlement) near the southern edge of the settlement buffer.

These watercourses and their tributaries are major landscape and semi-natural features of significant conservation importance. The River Wye is both a UK and EU Protected Site (SSSI and SAC designations). The River Monnow is of local importance and is designated a Watercourse SINC. They divide the settlement into three main regions of varying size:

- Monmouth town centre & Osbaston area
- Overmonnow & Wonastow area including Vauxhall Fields
- Mayhill & Wyesham area

The settlement is further divided by the A40 dual carriageway which runs north-south through the eastern part of the settlement, adjacent in large part to the River Wye.

The settlement supports a good variety of semi-natural features: both woodland and semi-improved species-rich grassland sites, which are by and large concentrated in the areas to the south of the Rivers Wye and Monnow. By comparison, this project has identified very little woodland or semi-improved species-rich grassland in the area to the north of the Rivers (Osbaston area).

Two of the grassland sites are current SINCs (Wonastow Field and Wyesham Lane SINCs). ASNW transcends the settlement boundary at both the south and west of the settlement. The largest patches of semi-improved species-rich grassland and ASNW, interconnected with small watercourses, are located at the south and west edges of the settlement.

Primary routes of connectivity within Monmouth are represented by linear features which provide value for the movement of species. These are represented by the Rivers Wye and Monnow and associated watercourses, plus the verges of the A40 dual carriageway.

Summary - Identified habitat connections include:

1) **The Rivers Wye and Monnow**. Their banks are generally lined with trees (some being Veteran specimens) or scrubby vegetation bordered beyond by agricultural fields or centrally, the built environment of urban Monmouth. The

River Monnow corridor extends to include a larger area of woodland in the north. A series of small semi-improved grasslands and woodlands connect with the River Monnow corridor along its length via tree lines and smaller watercourses; this includes Monmouth Cemetery to the north of the Monnow. The rivers have extensive influence throughout the settlement and provide a valuable corridor for the movement of wildlife through Monmouth and into the wider countryside.

2) **The A40 dual carriageway** runs north-south through the settlement. In the south it passes through a tunnel. Sections of its verges are tree lined, however regions of the road near the Wye Bridge are apparently without semi-natural verges. The dual carriageway runs in close parallel with the River Wye through much of the settlement. The verges and associated semi-natural habitat represent a linear corridor for the movement of species in and out of Monmouth.

3) **A cluster of ASNW and semi-improved species-rich grassland** enclosures centred on Whitehill Wood, and linked with a small watercourse (in the west of the settlement near Watery Lane). This is the largest block of semi-improved species-rich grassland and woodland identified by the project within Monmouth. It links and extends beyond the settlement boundary through its connection with an extensive area of ASNW that includes King's Wood. A further patch of semi-improved species-rich grassland and woodland (which includes some of Lord's Grove SSSI) is located at the east edge of the settlement.

4) **A disused viaduct** provides a linear corridor at the southern edge of the settlement connecting with the River Wye, River Monnow and A40 dual carriageway corridor. It also lies close to St Dial's Wood ASNW, further providing an aerial corridor.

5) The **Clawydd du ditch**, ditch and tree line along Wonastow Road and ditches, semi-improved grassland and trees of Wonastow Field grassland SINC are also identified in the existing connectivity map.

5) The settlement supports an **extensive hedgerow network,** providing connectivity to the features above and so augmenting the main connectivity network. They also connect with hedgerow networks outside the settlement and so to other features of biodiversity importance and aid the free movement of wildlife into the wider landscape. Hedgerows also provide more local connections between field units.

Monmouth is known to support a number of ancient hedgerows and from aerials several hedgerows appear to support large standard/mature trees, for example the hedge/tree line along Watery Lane. Field systems and their accompanying hedges are particularly concentrated within the western half of the settlement. Here well connected hedgerows link to some of the largest blocks of semi-natural habitat within the settlement; i.e. the ASNW woodland and species-rich grassland centred on Whitehill Wood, and St Dial's Wood.

The hedgerows also link into wider hedgerow networks that connect to important blocks of semi-improved habitats beyond the settlement boundary, such as ASNW woodlands including Orles Wood and Buckholt wood to the north and the ASNW woodlands and species-rich grasslands of the Wye Valley to the south. Many of the hedgerows in this part of the county are known to be important foraging/migration routes for bats.

Hedgerows are also found in the more residential parts of the settlement. The northern part of the settlement (centred on Osbaston and Monmouth town centre) contains a number of well established large gardens. These together with associated mature trees and hedgerows provide an important biodiversity resource within the more urban regions of the settlement.

Gardens form a significant habitat in Monmouthshire. The linear nature of many of the settlements in the county means that gardens are often close to open countryside and are therefore rich in wildlife. They also provide wildlife corridors enabling the free movement of species.

The features above are interconnected and together form a major route of connectivity with the settlement.

Connectivity with the wider landscape

Monmouth is situated in close vicinity to an area of European conservation importance. The River Wye flows through the settlement and, in doing so, connects Monmouth to an ecological network of European importance; the River Wye, its gorge and associated Wye Valley Ancient Semi-Natural Woodlands receive both SAC and SSSI designations. Particularly close to the south east of the settlement are several SSSIs: Livox Wood, Harper's Grove - Lord's Grove and Fiddlers Elbow, with Lord's Grove SSSI partially entering the settlement boundary.

The settlement is further nestled amongst a series of other ASNW including King's Wood to the west, Buckholt wood to the north, and Highmeadow Woods (which connect with Wye Valley Woodlands SSSI network) to the east. The ASNW parts of these woodlands qualify as SINCs.

The A40 dual carriageway and its extensive verges provide further connectivity into the wider landscape.

The broadleaved woodland network of the lower Wye Valley is highlighted as an extensive network within CCW's core and focal networks ecological connectivity study[40].

The Wye Valley and Forest of Dean Bat Sites SAC lie scattered across the Wye Valley with the most relevant site for this settlement just 0.6km from the settlement at Newton Court SSSI. Greater horseshoe bats are particularly

[40] Latham *et al*

important and will rely on good quality habitat networks for foraging and commuting, particularly cattle grazed pastures.

Opportunities to strengthen existing connectivity

Strengthen the existing primary route of connectivity and overcome barriers.

1) Strengthen the A40 corridor: ensure tree line and hedgerows are well connected and sensitively managed. Ensure sensitive management of grassland verges.

2) Strengthen the major river corridors, the most extensive semi-natural corridors in and out of Monmouth. Ensure a buffer of semi-natural habitat with adjacent fields and the built urban landscape and connect with near-by areas of semi-natural habitat where possible. Extend this to include smaller watercourses, many of which are culverted through the residential zones of Monmouth. This will present a barrier to the movement of some wildlife. Explore how significant a barrier it represents and determine the possibility of reinstating the watercourse.

3) Ensure hedgerows are sensitively managed and well-connected.

4) Ensure current blocks of semi-natural habitat and protected sites are sensitively managed and their extent increased where appropriate.

5) Improve linkage of the disused viaduct with other nearby semi-natural habitats to further bolster corridors through the settlement, e.g. linkage to St. Dial's Wood ASNW.

Opportunities to enhance connectivity

The major opportunities for enhancing habitat connectivity are identified to be the forming of a link between the central extensive corridor dominated by the Rivers Wye and Monnow and other smaller habitat corridors.

The opportunity to better connect the Watery Lane watercourse, semi-improved grassland and ASNW unit (at the west of the settlement) and the central extensive corridor dominated by the Rivers Wye and Monnow is highlighted. An area of woodland (adjacent to Monmouth Fire Station) lies between these two corridors and although not physically connected, may already provide a stepping stone between the two.

Opportunities are also highlighted to link a strip of woodland and grassland situated between Wyesham and the May Hill) Industrial estate with the main River Wye corridor. Opportunities are highlighted both at the north and south ends of the strip.

Frequent opportunities to enhance connectivity between different sections of the main route of connectivity are centred on the ditch, semi-improved

grassland and woodland habitat in and around Wonastow Industrial estate. Examples include the opportunity to enhance connectivity between the northern tip of the Clawdd du ditch and the Wonastow road ditch, as well as improving connectivity between these sections of ditch and Drybridge pond and the 'fire station woodland' to the north. The opportunity for enhancing connectivity between the western end of the Wonastow Road ditch and semi-improved grassland and St Dial's wood to the south is also highlighted.

Opportunities are also identified to enhance connectivity between Wonastow Field SINC and the ditch and semi-improved grassland to the south and Watery Lane to the north.

Further opportunities are highlighted to enhance connectivity between the main semi-natural habitat network (as identified in this study) in Monmouth and a variety of small additional habitat patches. These are scattered across the settlement. For example small patches of trees are situated between the watery lane ditch and Wonastow road ditch.

Dormice and Woodlands/Hedgerows

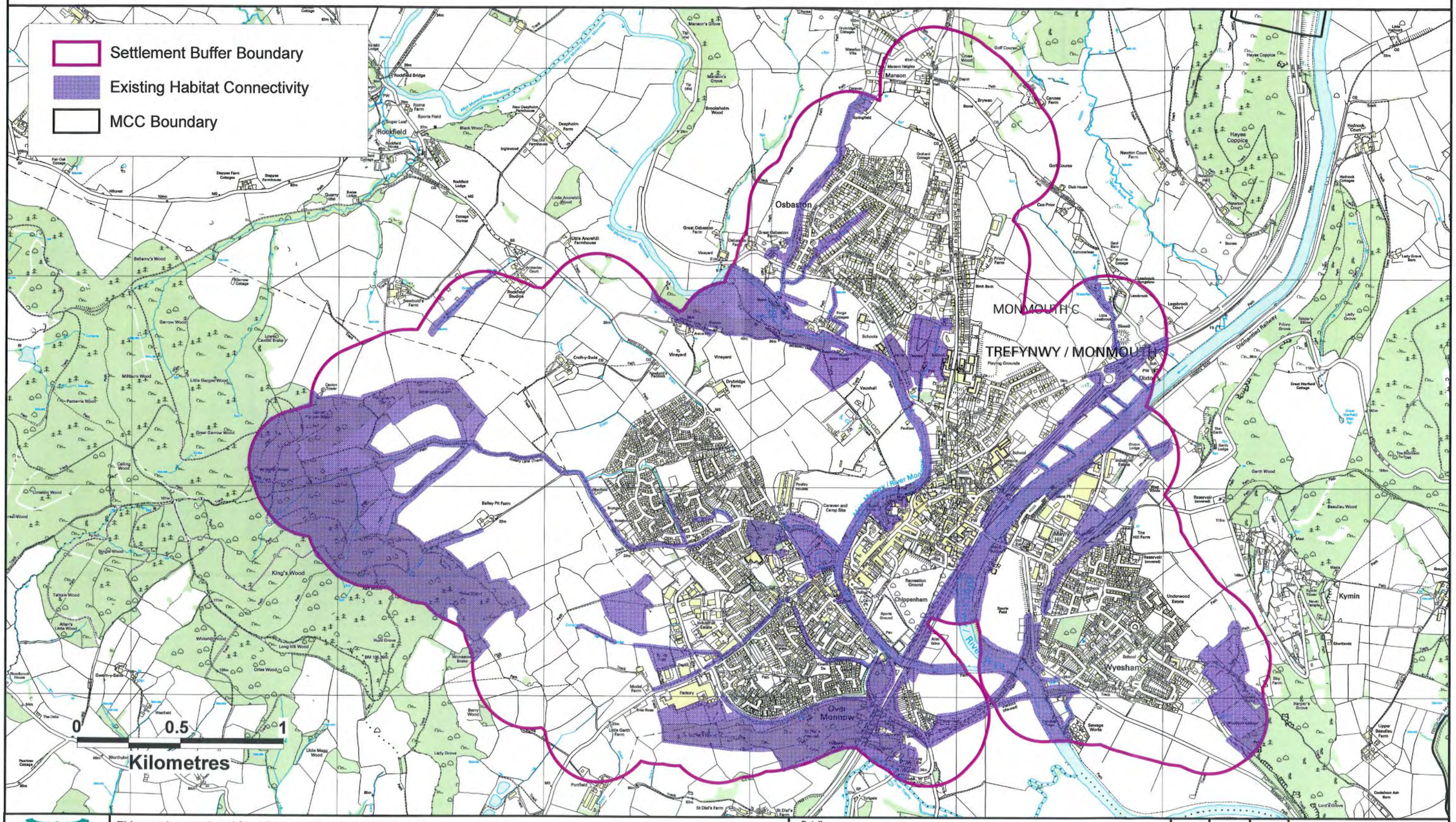
Hedgerows and woodlands connected to known dormouse records are identified in the south (radiating out from St Dial's wood ASNW and Harper's Grove - Lords' Grove SSSI) and west (radiating out from the Kings' Wood ASNW complex) of the settlement.

Opportunities are identified to connect the three discrete areas above with additional potential habitat for dormice within the settlement, which are largely to be found in the eastern half of the settlement.

A line of opportunities to link the hedgerow network in the west of the settlement with the unconnected hedgerows in the east is particularly evident. This line follows the edge of the western part of the urban zone of Monmouth, at the interface between the more open countryside and the private residences and industrial estates of Rockfield, Drybridge and Wonastow.

Opportunities to enhance connectivity between the trees/scrub of the disused viaduct and neighbouring woodland and hedgerows are also highlighted. Current physical connectivity to this nearby woodland and hedgerows within the settlement is limited due to the barrier created by the River Wye and Beech Road. The viaduct is however connected to hedgerows to the south, outside the settlement boundary.

Monmouth: Habitat Connectivity Map



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Fry.D	1:18000	13/04/2010			
Ecological Connectivity Assessment of Settlements in Monmouthshire					

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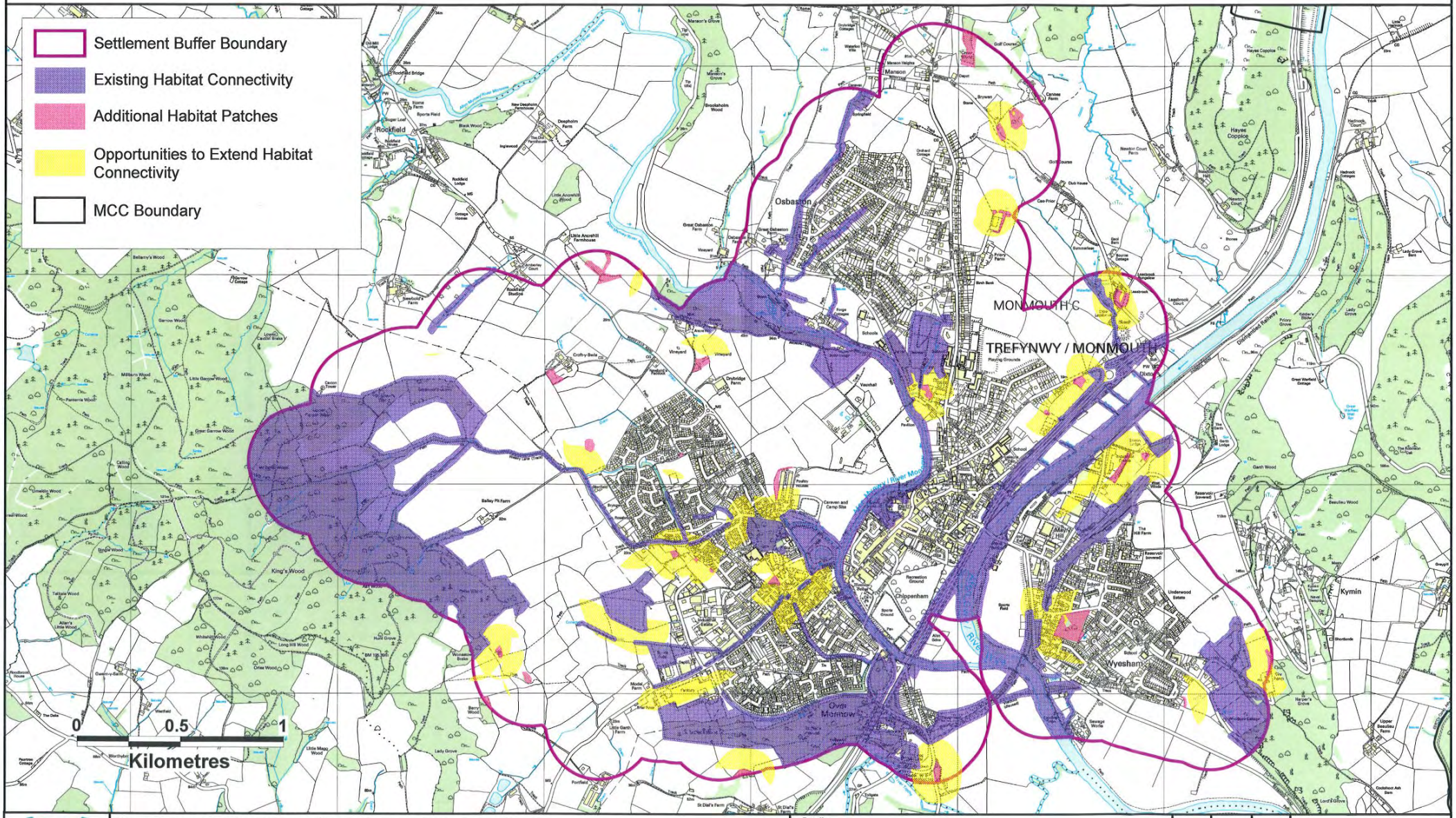
Monmouth: Habitat Connectivity Opportunities Map



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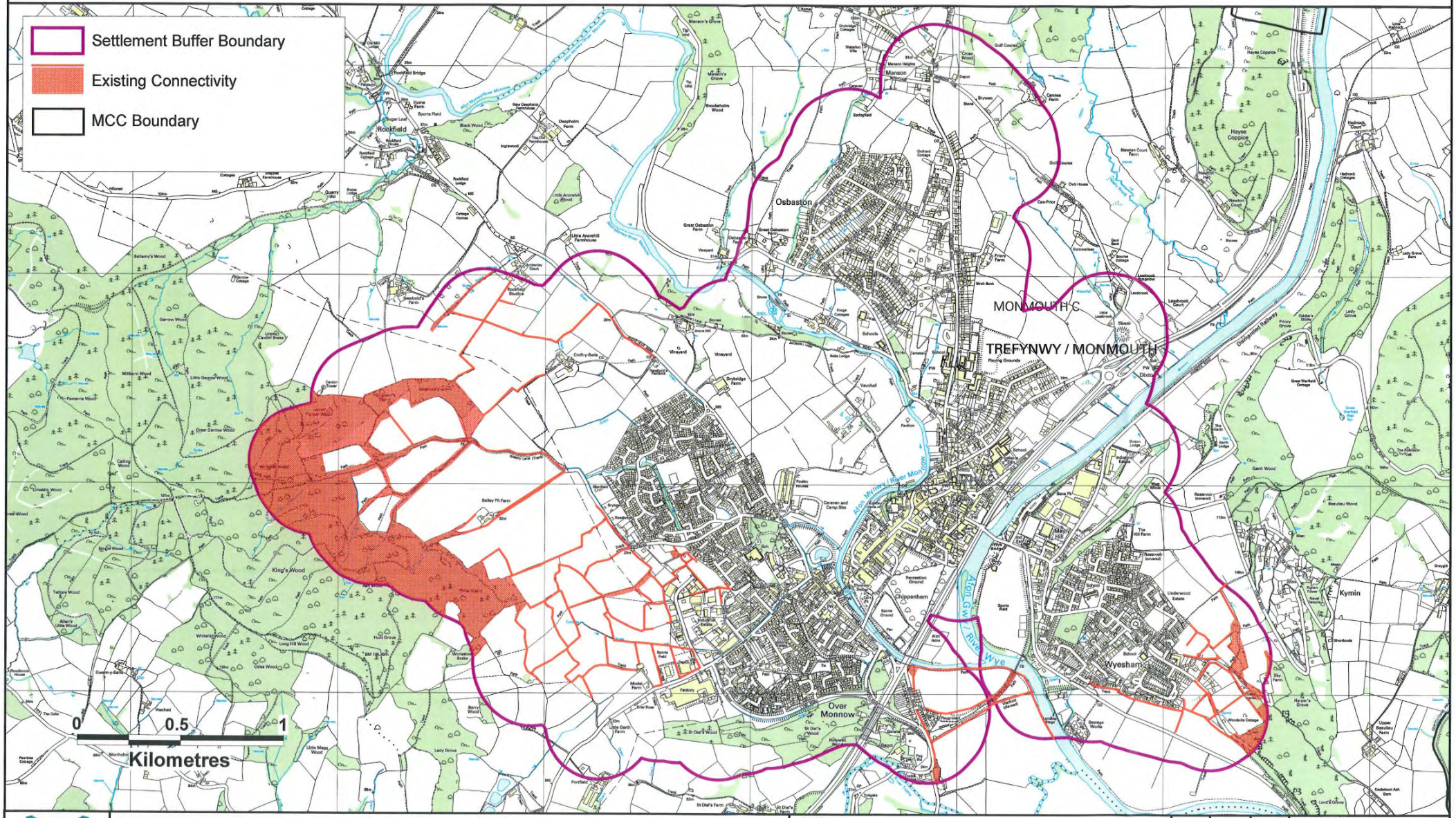
Monmouth: Dormouse, Woodlands & Hedgerows Connectivity Opportunities Map



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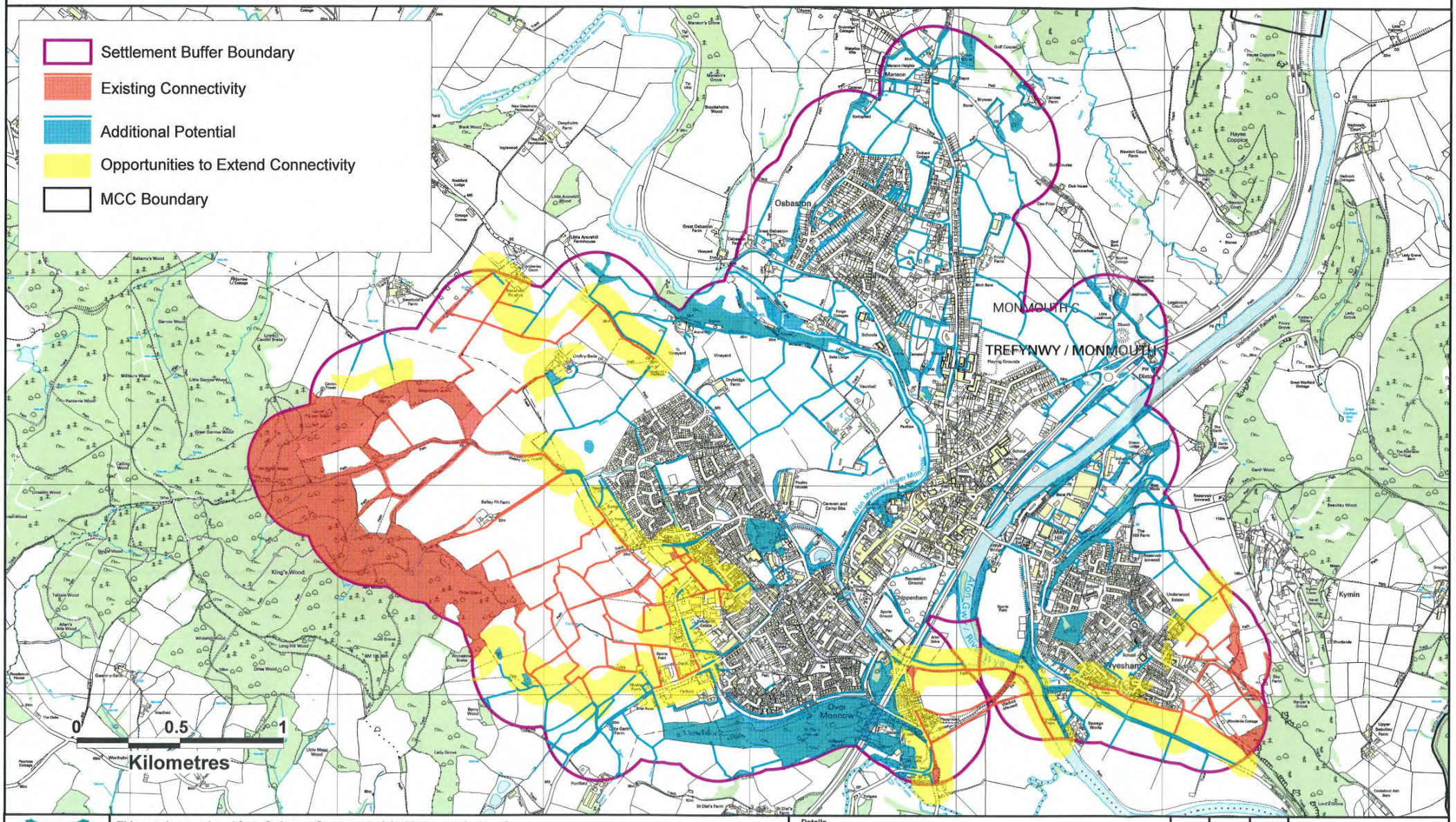
Monmouth: Dormouse, Woodlands & Hedgerows Connectivity Opportunities Map



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Ecological Connectivity Assessment of Settlements in Monmouthshire			

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5.2.5 Settlements 9-10: Abergavenny & Llanfoist

Existing habitat connectivity within the settlement

The settlements of Abergavenny and Llanfoist lie in such close vicinity that they were combined for the purposes of this assessment.

Abergavenny town, as its name reveals, is situated at the confluence of a tributary stream, the Gavenny, and the River Usk and is located 24km west of Monmouth on the A40 and A465 roads, and 10km from the English border within the Welsh Marches. The Black Mountains lie to the north, and are part of the Brecon Beacons National Park. Abergavenny is almost completely surrounded by two mountains: the Blorenge (559m) and the Sugar Loaf (596m) and five hills: Skirrid Fawr, Skirrid Fach, Deri, Rholben and Mynydd Llanwenarth.

Llanfoist village is sited to the south of Abergavenny beneath the Blorenge Mountain. The Monmouthshire and Brecon Canal is situated just below the village.

The A465 is split into two sections. Firstly the A465 'Hereford road' runs north-south through the settlement, near its eastern edge. Running parallel to this is a mainline railway. Secondly the recently dueled A465 'Heads of the Valleys road' runs east-west through the southern half of the settlement and divides Abergavenny from Llanfoist. The A4143 connects with the A465, and travels north into Abergavenny. Linked to the south side of the A465 is a section of dismantled railway.

The River Usk is a feature of European conservation importance (with SAC and SSSI designations) and flows for its most part to the north side of the Heads of the Valleys Road and again divides Abergavenny from Llanfoist. The River Gavenny, which is a locally protected site (SINC), flows north-south through eastern Abergavenny until its confluence with the River Usk. To the south of Llanfoist lies the Monmouthshire and Brecon Canal.

Further smaller watercourses extend into the settlement and connect with these main rivers and help provide connectivity between the river corridors and nearby woodland and semi-improved species-rich grassland units. For example the Afon Cibi, which is apparent as a series of short sections on the OS map and flows through the more urban centre of Abergavenny and is therefore an important corridor through this part of the settlement. Watercourses represent a significant ecological network within the settlement.

Other protected sites include the Cwm Mill Section, Mardy SSSI situated between the River Gavenny and railway line. The Sugar Loaf Woodlands ASNW SAC and SSSI partially crosses the northern boundary of the settlement, whilst Coed-y-person ASNW SSSI connects with the south west edge of the boundary, adjacent to Llanfoist. Grove Farm grassland SINC is located at the southern edge of Llanfoist.

Within Llanfoist, other notable semi-natural features include the semi-improved species-rich grassland, stream, pond and woodland unit centred on Evesham House in the north (which connects with the A465 and River Usk corridor) and the species-rich grassland, pond and ditch network of Grove Farm SINC in the south.

The River Gavenny, Usk and connected watercourses, A465 dual carriageway, A4143 Merthyr Road and railway linear features (which predominantly skirt the east and south of the main urban zone of Abergavenny), are all interconnected and are the main features of connectivity with significant physical influence through the settlements.

Summary - Identified habitat connections include:

1) **The River Usk and River Gavenny.** The banks of the Usk are generally quite open, with the exception of the vicinity of the Usk Bridge where patches of woodland adjoin the river. The River Gavenny is lined by trees and small woodland units for its most part widening the semi-natural network; however it is culverted at a number of small road junctions.

These main rivers are further extended by a series of smaller watercourses which flow into them including the Afon Cibi (through central Abergavenny) and Nant Iago (north east edge of settlement). Though often rather disjointed, together they represent a significant corridor through the settlement.

2) **The A465** runs north-south from Hereford near the settlement's eastern boundary and west between Abergavenny and Llanfoist towards the Heads of the Valleys. Running parallel to the A465 'Hereford Road' is the mainline **railway** between Wales and the Midlands. Hereford Road and the railway have extensive verges with dense tree lines and semi-improved grassland.

This linear network widens in places to include adjacent semi natural habitat, for example to the south of the A465 Head's of the Valleys road' semi-improved species-rich grassland, stream, pond and woodland unit is centred on Evesham House. This part of the A465 corridor is also enhanced by connectivity to the A4143 running north through Abergavenny and a section of dismantled railway which lies at the west edge of Llanfoist.

It should be noted that the section of the A465 'Heads of the Valleys Road' has recently be widened to become dual carriageway. Many of its associated verges were verges realigned and re-sown.

3) **Grove Farm semi-improved species-rich grassland SINC, pond and ditch** network, south of Llanfoist.

4) **Semi-improved species-rich grassland and woodland centred around The Hill College**.

5) **The Monmouthshire and Brecon Canal** adjoins the ASNW SSSI of Coed-y-person. The canal presents a significant corridor through the settlement.

6) **Series of smaller mixed habitat blocks**, for example the trees and watercourse of Bailey Park, woodland and watercourse near St Teilo's vicarage, the parkland and semi improved grassland of Maindiff Court Hospital and trees and watercourse south of Belmont Crescent.

7) **Hedgerows**. The most extensive sections are concentrated towards the edges of the settlement in association with fields. They provide connections to the linear features listed above and to hedgerows outside of the settlement. For example there is some connectivity through hedges between the tree lined verges of the A465 and woodland of Skirrid Fach to the east of the settlement boundary.

The features above are interconnected and have extensive influence. Together they provide the main linear route of connectivity through and out of the settlement.

Connectivity with the wider landscape

Abergavenny and Llanfoist are surrounded by the Blorenge and Sugar Loaf mountains and a series of hills which form part of the Brecon Beacons National Park. In the local and wider region of the National Park this includes a number of SSSIs from the ASNW woodland on the slopes of the Sugar Loaf and Blorenge (which enter the settlement boundary) to the upland habitats of the Black Mountains to the north and the Usk Bat Sites SAC.

The River Usk has huge ecological influence and together with its tributaries provides a far reaching route of connectivity between the settlement to the wider landscape and ecologically important sites such as the Black Mountains. Additionally the A465 and railway provide corridors of extensive physical influence in the wider landscape including links to the large woodland habitat network that arcs across the Heads of the Valleys uplands of the South Wales Valleys (as identified in CCW's core and focal networks ecological connectivity study)[41].

The Usk Bat Sites SAC lie north (Foxwood SSSI 4.8km), south west (Siambre Ddu SSSI 3.5km) and west (Mynydd Llangattock 6.2km, Buckland Hall, 16km) of the settlement. Lesser horseshoe bats are one of the features of the SAC and will use the networks of semi-natural habitats within the settlement to commute and forage.

Opportunities to strengthen existing connectivity

Strengthen the existing primary route of connectivity and overcome barriers.

[41] Latham *et al*

1) Strengthen the A465 and railway corridor: ensure tree line and hedgerows are well connected and sensitively managed. Ensure sensitive management of grassland verges.

2) Strengthen the major river corridors, the most extensive semi-natural corridors in and out of Abergavenny. Ensure a buffer of semi-natural habitat with adjacent fields and the built landscape and connect with near-by areas of semi-natural habitat where possible. The culverts on the River Gavenny will present a barrier to the movement of some wildlife. Exploration of how significant a barrier it represents, in order to help inform the need for a possible resolution may be of value. Extend this to include smaller watercourses: which are also culverted through the main urban zone, e.g. the Afon Cibi.

3) Ensure hedgerows are sensitively managed and well-connected.

4) Ensure current blocks of semi-natural habitat and protected sites are sensitively managed and their extent increased where appropriate.

Opportunities to enhance connectivity

Opportunities to enhance habitat connectivity include forming links between the main linear route of connectivity (represented by the interconnected River Usk, River Gavenny, A465, A4143 and railway) and semi-natural units around Llanfoist, including Grove Farm grassland SINC and the Monmouthshire Brecon Canal and the SSSI ASNW woodlands of the Blorenge.

Other opportunities include enhancing connectivity between The Hill site and the Sugar Loaf woodlands ASNW SSSI, and between the River Gavenny-railway-A465 corridor and the woodland and watercourse near St Teilo's vicarage. Opportunities are also identified to enhance connectivity between sections of the Afon Cibi in central Abergavenny and also to the trees and watercourse of Bailey Park, which itself could be better connected to the River Gavenny to its east.

Abergavenny supports numerous small patches of additional habitat, distributed across the settlement. Many opportunities are highlighted to enhance connectivity between these discrete patches and also to the main semi-natural connectivity networks that this study has identified, for example, linking the woodland and semi-improved grassland of Maindiff Court Hospital with the railway-A465 corridor to its north and west. Another example is to enhance connectivity between patches of trees in and around The Knoll and Nevill Hall Hospital and also to the Nant Iago to the west, the A4143 corridor to the east and a block of woodland, semi-improved grassland and a small tributary of the River Usk to the south.

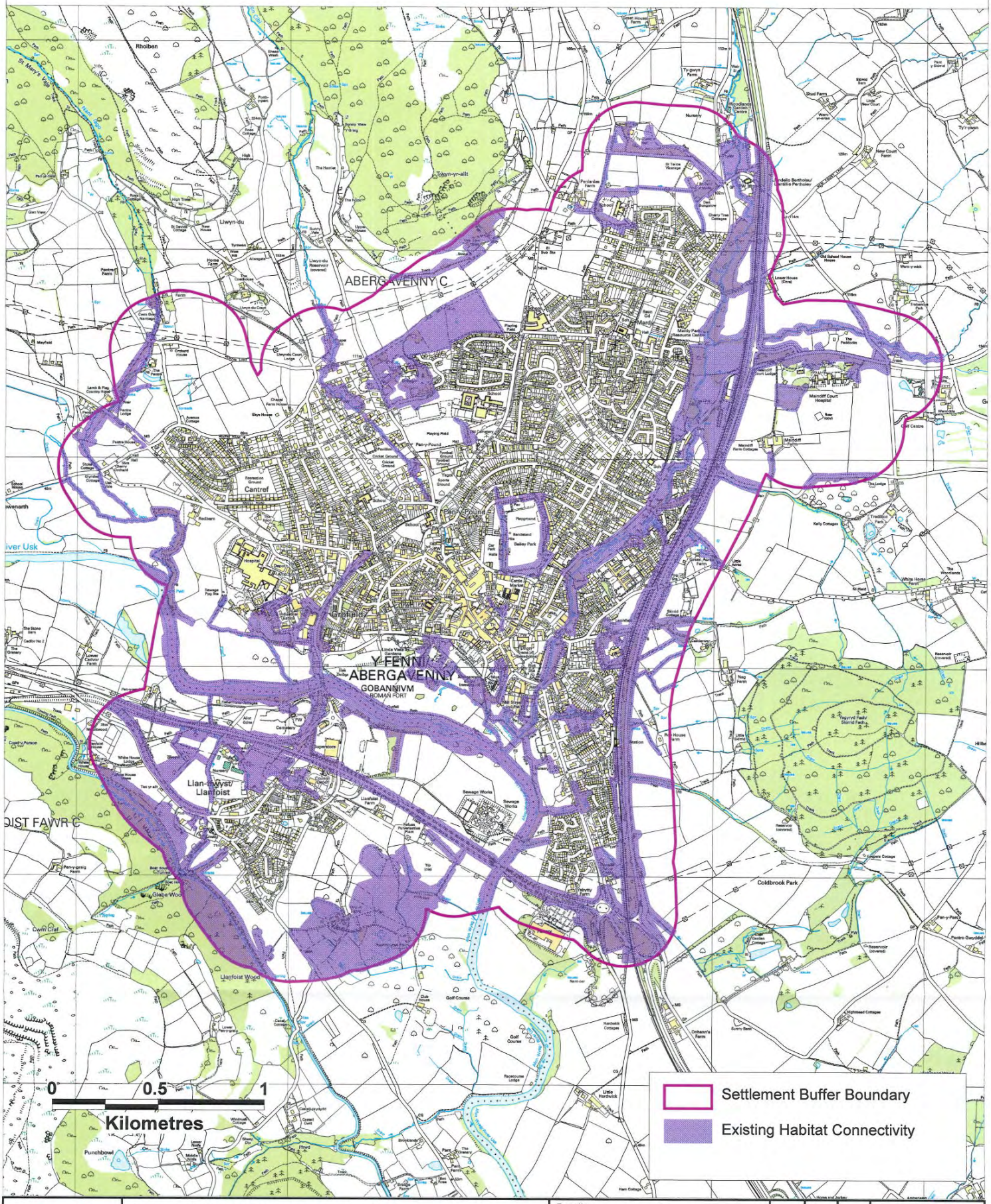
Great Crested Newts and Ponds

Clusters of connected ponds are largely concentrated towards the perimeter of the settlement, with a high density situated to the south of the River Usk in and around Llanfoist. Further clusters are situated to the east and south of the settlement, as well as to the north of Abergavenny. A high concentration of ponds is situated outside the settlement boundary to its east.

Opportunities are identified to enhance connections between the individual pond clusters within Llanfoist, and also to pond clusters to the south of Llanfoist.

Other opportunities are identified between a pond cluster at the eastern edge of the settlement and pond clusters around Skirrid fach to the south east and Tredilion Park and the Golf course to the north-east. This would bolster the connectivity both between ponds inside and outside of the settlement.

Abergavenny & Llanfoist: Habitat Connectivity Map



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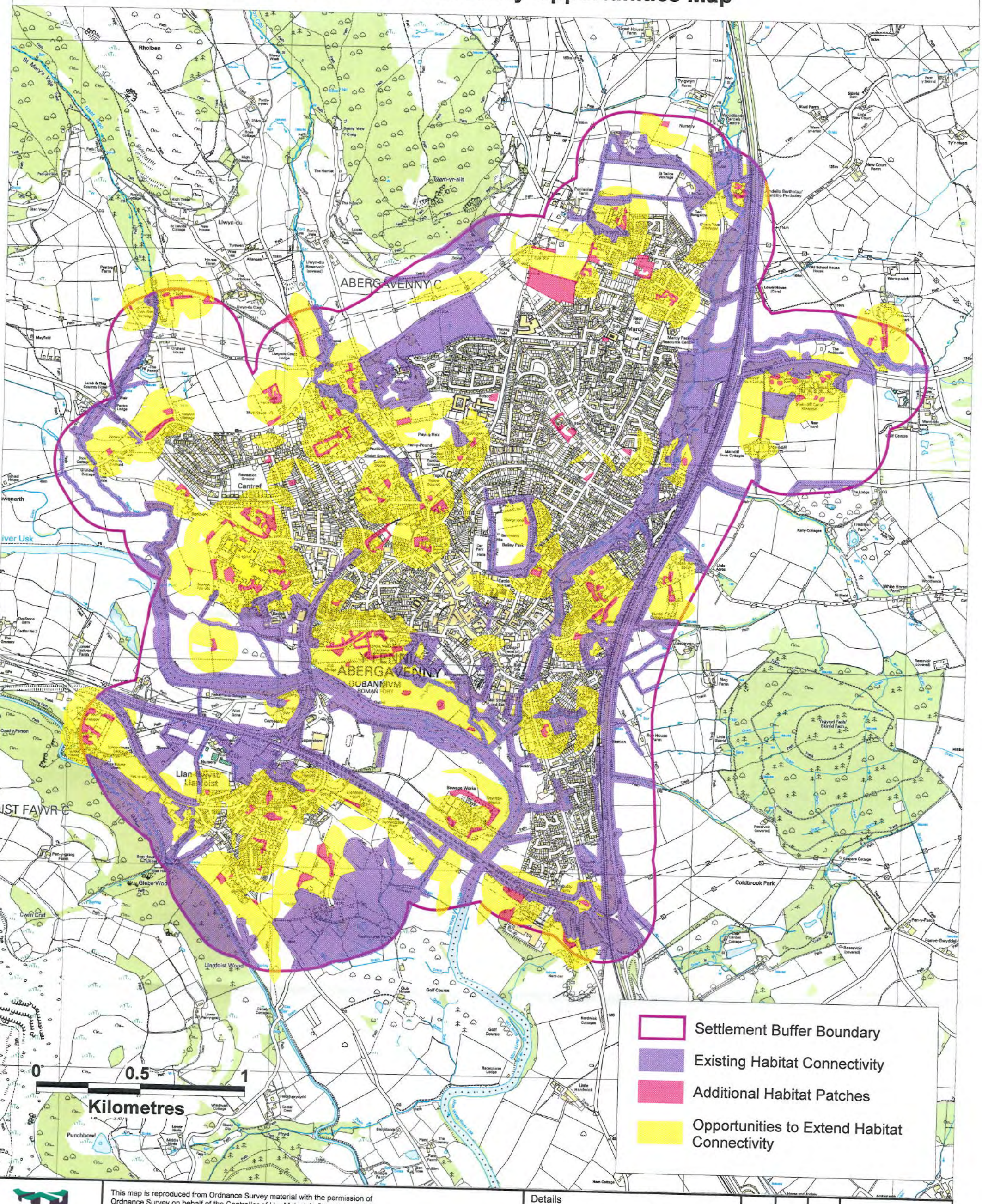
Abergavenny & Llanfoist: Habitat Connectivity Opportunities Map



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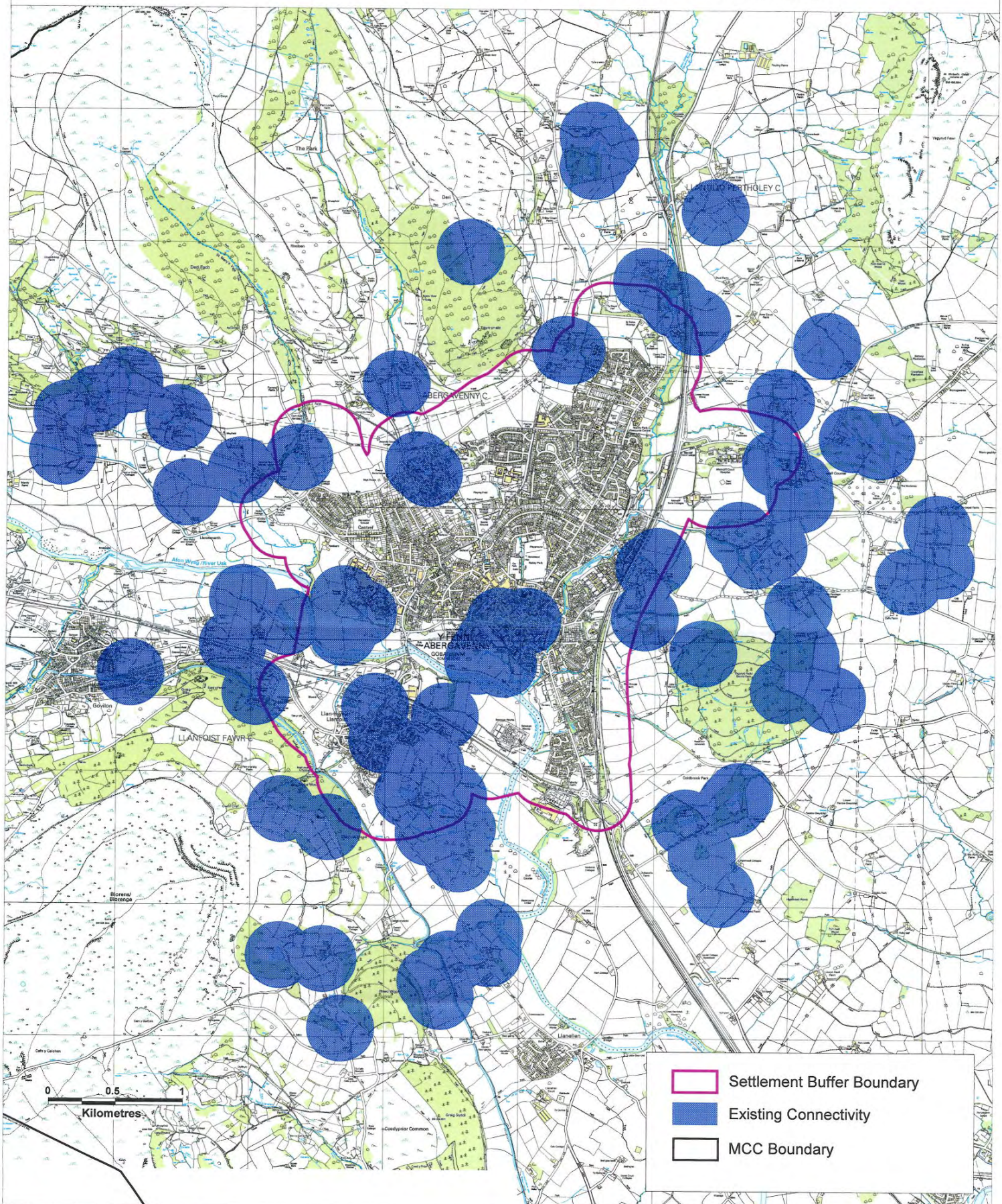
Abergavenny & Llanfoist: Great Crested Newt & Ponds Connectivity Map



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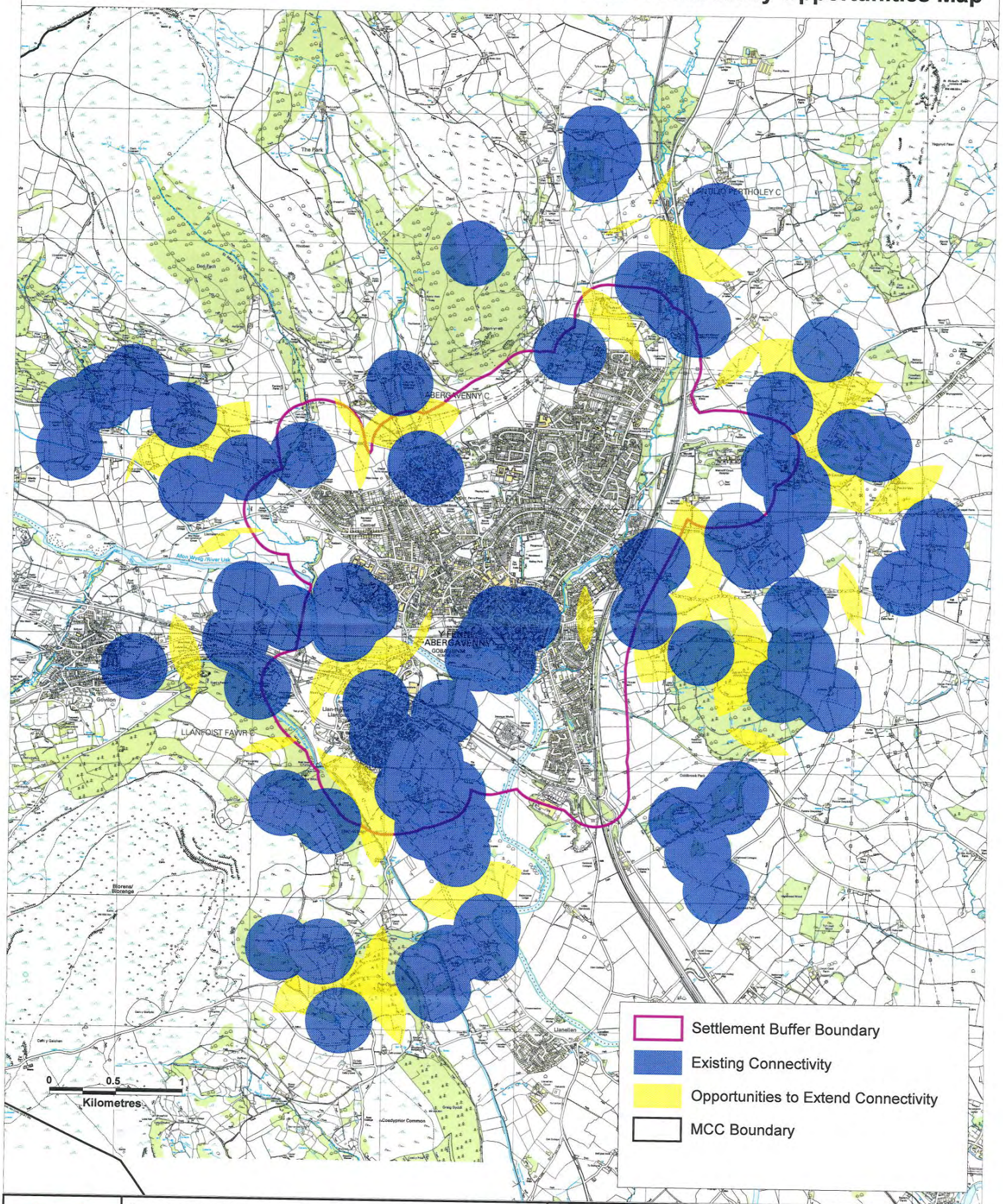
Abergavenny & Llanfoist: Great Crested Newt & Ponds Connectivity Opportunities Map



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5.2.6 Settlement 11: Raglan

Existing habitat connectivity within the settlement

Raglan is a rural village in central Monmouthshire. The A40 dual carriageway runs east-west through the northern half of the settlement, dividing the main village settlement from Raglan Castle and the surrounding agricultural fields, but providing linear connectivity within the wider landscape though its extensive roadside verges.

There are limited priority semi-natural features identifiable in Raglan, with the exception of hedgerows. No ASNW is recorded and the semi-improved species-rich grassland resource is very limited. No protected sites have been identified within the settlement.

Primary routes of connectivity within Raglan are represented by linear features, which provide value for the movement of species. Small interlinked watercourses represent the most extensive routes of connectivity; the Nant y Wilcae runs west to east along the southern side of the village, connected to the Barton Brook which runs north to south. Large sections of these watercourses are tree lined.

Summary - Identified habitat connections include:

1) **The Nant y Wilcae Brook** is situated along the southern edge of the village. Its banks are lined for the most part by trees, which connect in places to small areas of woodland. Its physical extent and semi-natural buffer make it a valuable corridor for the movement of wildlife through Raglan and into the wider countryside.

2) **The Barton Brook** extends north to south through central Raglan. It is, however, culverted under the A40, which presents a barrier to continuous movement of wildlife through Raglan.

The northern section is lined by mature trees, woodland and scrub and rough grassland and presents a valuable corridor for wildlife. The southern section is tree lined along much of its length. The value of the corridor is reduced through the village itself where the semi-natural buffer is reduced by the close vicinity of private residences. Despite the barrier presented by the A40 to movement along the extent of the Barton Brook, both the southern and northern corridors extend and link with other linear features outside the settlement boundary making the Brook a valuable ecological feature in Raglan.

3) **The A40 dual carriageway** runs along the northern edge of the village. Much of the verges are lined with well-established broadleaved trees together with semi-improved grassland. The verges and associated semi-natural habitat represent an important corridor for the movement of species in and out of Raglan.

4) **Hedgerows** are evident around many of the agricultural fields surrounding the village of Raglan. The hedgerows appear to be of variable condition and are defunct in many cases as stockproof field boundaries. However they provide local connections to the linear features listed above; for example augmenting the tree lined Barton Brook and Nant y Wilcae corridors. Furthermore they provide linkage to hedgerow networks beyond the settlement boundary, aiding the potential movement of wildlife.

Connectivity with the wider landscape

Unlike many other villages, Raglan's growth has not been focused around a major watercourse but rather around the castle. It is relatively isolated from ecologically valuable sites in the wider landscape.

There are no statutory protected sites close to Raglan. Two small grassland SINCs lie c0.5km from the buffer boundary. There are several ASNW SINCs surrounding the village but the nearest is over a 1km away. Small watercourses, hedgerows and the verges of the A40 dual carriageway provide the major corridors for species movement in and out of Raglan. The A40 also connects with the A449 dual carriageway further extending its potential value as a linear connectivity feature.

Opportunities to strengthen existing connectivity

Strengthen the existing primary route of connectivity and overcome barriers.

1) Strengthen the robustness of the south end of the Nant y Wilcae corridor. Widen the buffer with adjacent arable fields, and reinforce habitat linkage with the Barton Brook. Strengthen the north end of the Barton Brook Corridor.

3) Strengthen the A40 corridor: ensure tree lines and hedgerows are well connected and sensitively managed. Ensure sensitive management and extension of grassland verges. The dual carriageway splits the Barton Brook corridor, with the brook culverted underneath it. The culvert will present a barrier to the movement of some wildlife. Exploration of how significant a barrier it represents, in order to help inform the need for a possible resolution may be of value.

4) Strengthen the connectivity of watercourses, the most extensive semi-natural corridors in Raglan.

5) Ensure hedgerows are sensitively managed and well connected.

6) Ensure current blocks of semi-natural habitat and protected sites are sensitively managed and their extent increased where appropriate.

Opportunities to enhance connectivity

Opportunities for enhancing habitat connectivity are identified to be building a link between the northern and southern end of a small watercourse (in the east of the settlement) and the rest of the primary route of connectivity.

Four further opportunities are identified to form/enhance links between the primary route of connectivity and additional habitat patches located to the south of the A40 dual carriageway. These habitat patches comprise small groups of trees.

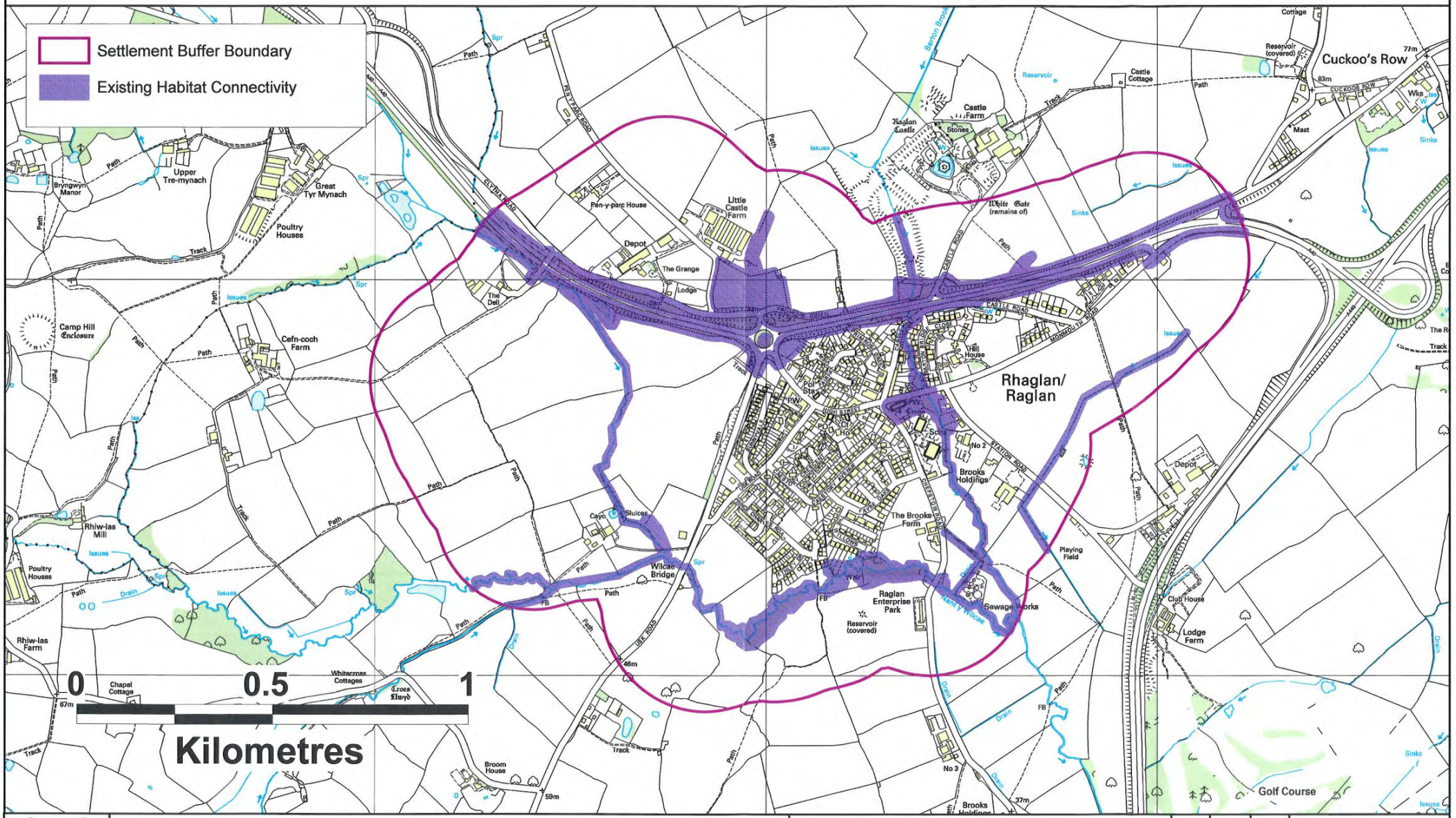
Great Crested Newts and Ponds

Clusters of connected ponds are identified both within and to the north and south of Raglan.

Opportunities are identified both to connect clusters within the settlement (forging a link between pond clusters in the east and west of the settlement), but also to improve connectivity with ponds beyond the settlement boundary. Improving connectivity with ponds beyond the settlement boundary may be the more appropriate option; encouraging GCN movement around the perimeters of the main urban area and also into the wider landscape rather than through the built environment of Raglan.

Examples include the opportunities to link ponds in the north west of the settlement, to the two ponds near Cefn-coch farm and Great Mynach Farm and also to link the concentration of ponds in the east and south of Raglan to a pond cluster by Twyn-y-Sherriff.

Raglan: Habitat Connectivity Map



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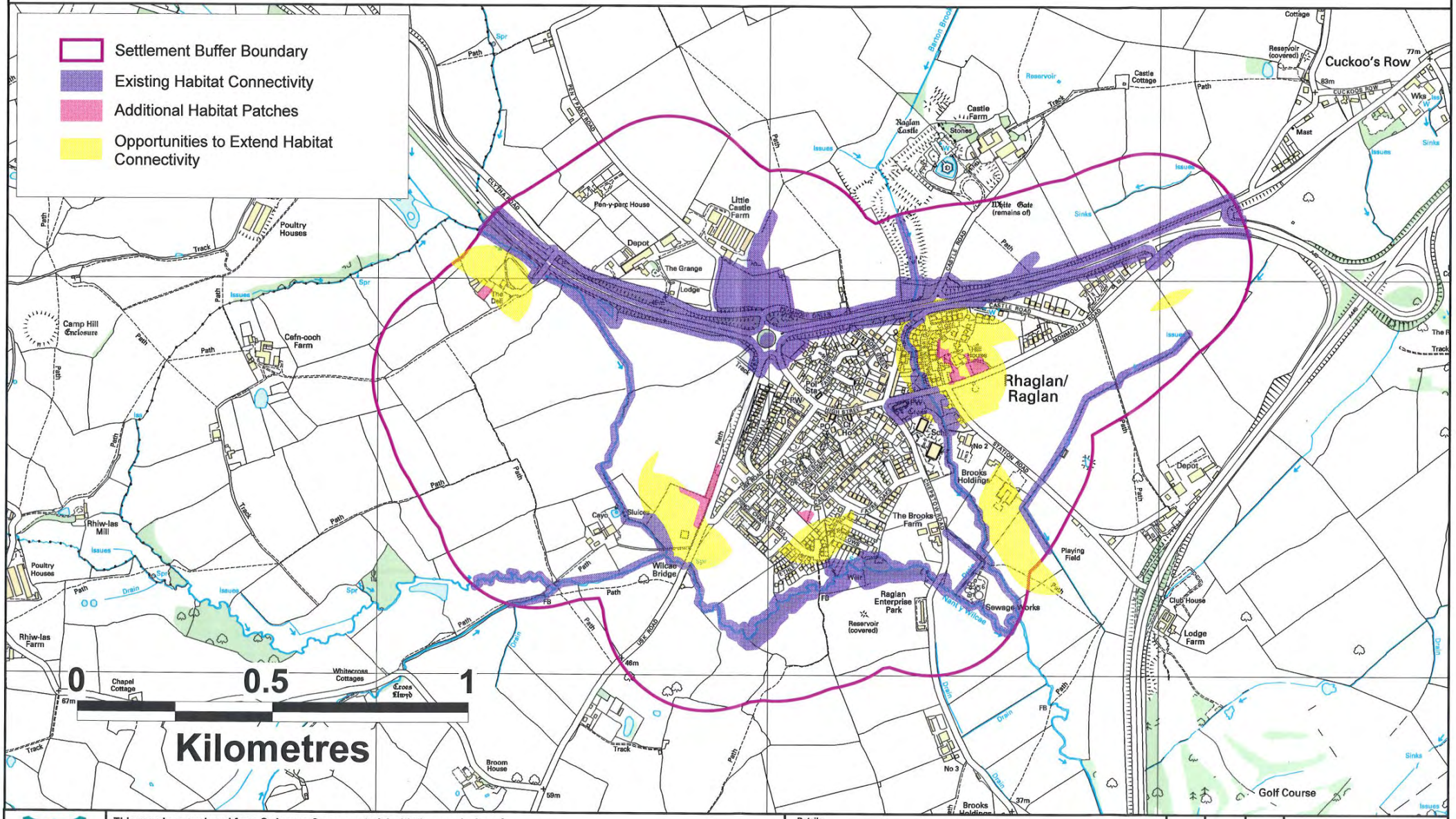
Raglan: Habitat Connectivity Opportunities Map



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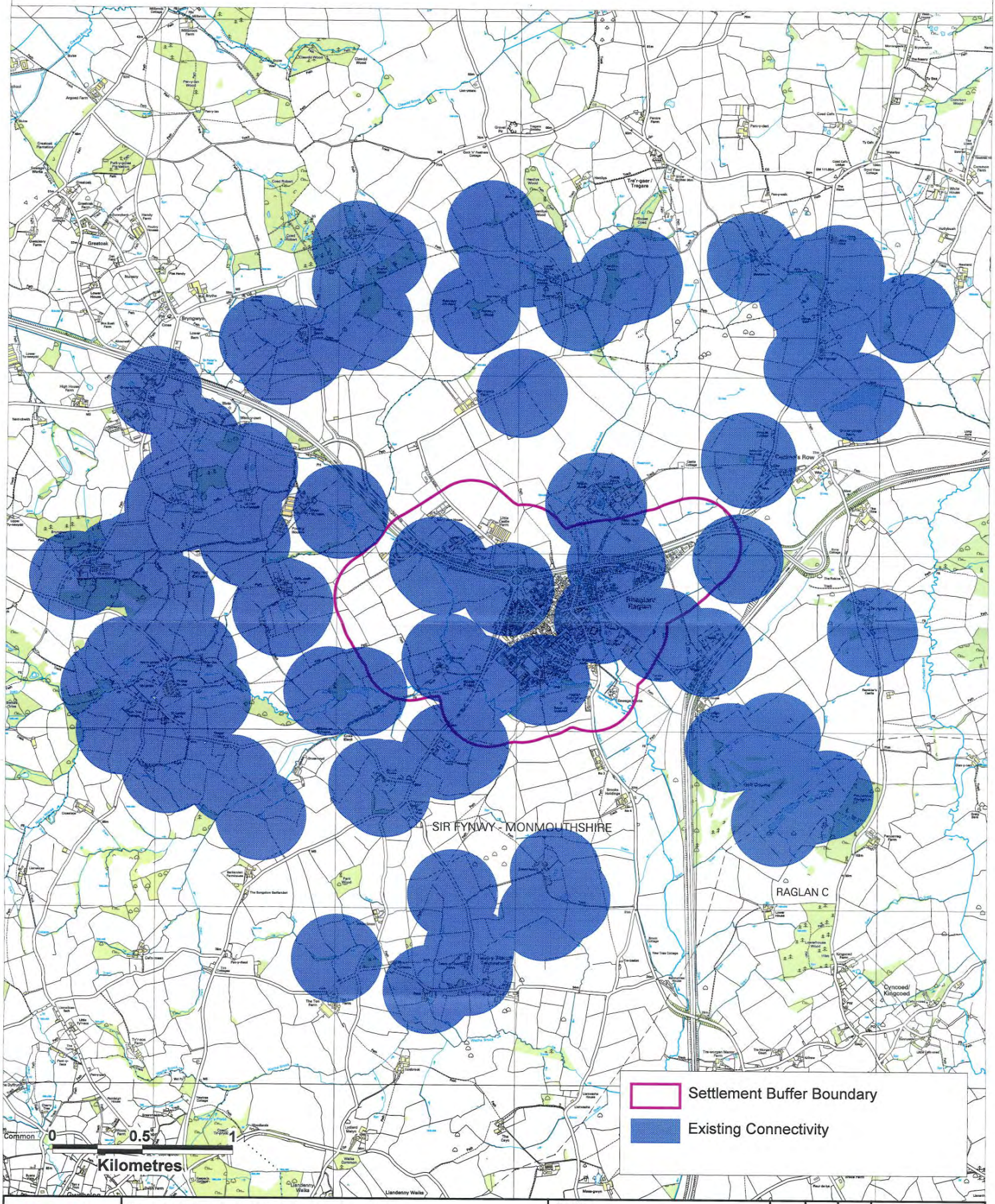
Raglan: Great Crested Newts & Ponds Connectivity Map



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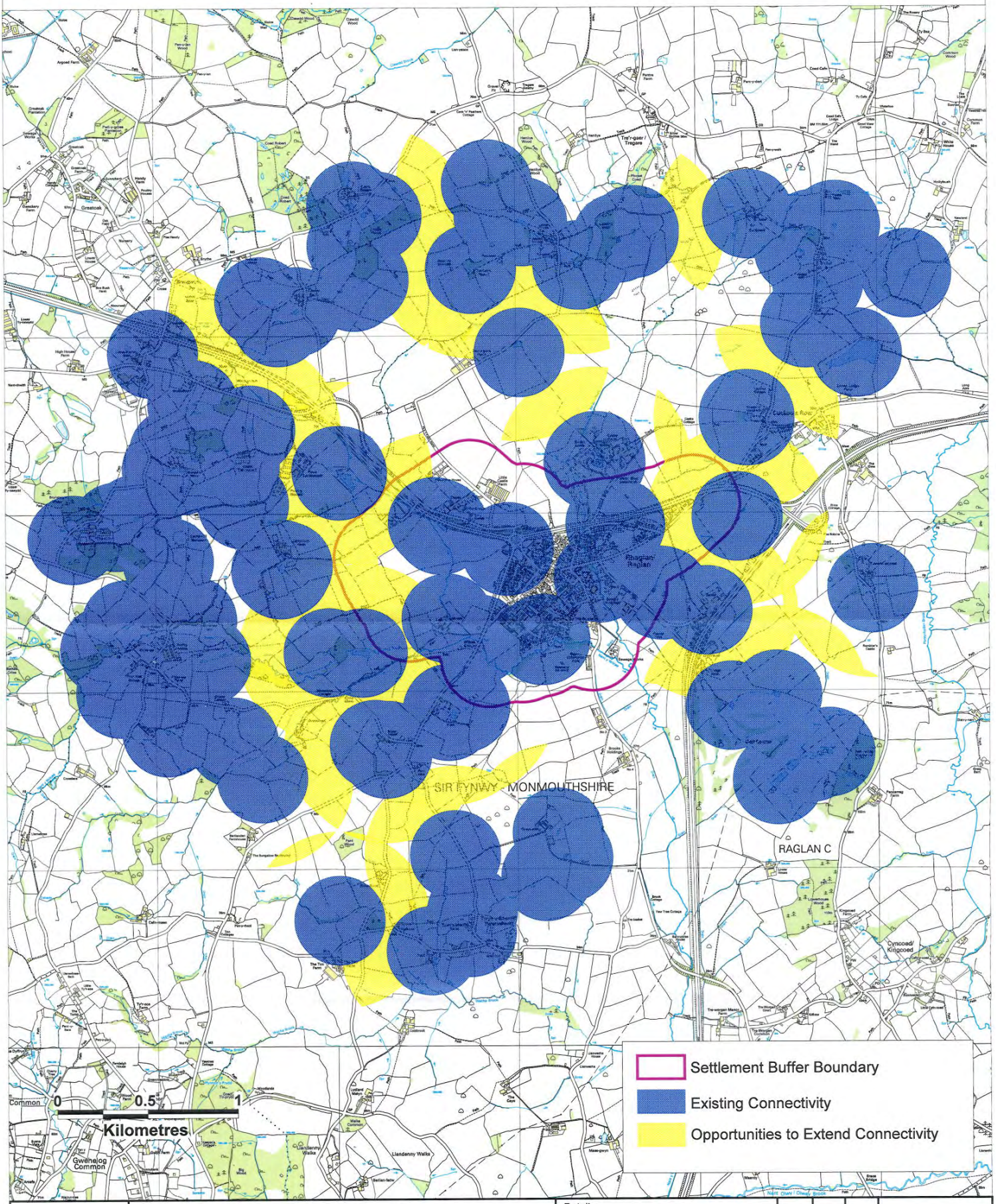
Raglan: Great Crested Newts & Ponds Connectivity Opportunities Map



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5.2.7 Settlement 12: Penperlleni

Existing habitat connectivity within the settlement

Penperlleni is a small village located between Usk and Abergavenny. A railway line runs north-south through the settlement dividing it into two, yet providing considerable linkage into the wider landscape. The settlement does not contain any main rivers but smaller watercourses provide linear corridors and links with other semi-natural corridors through the settlement and feed into the River Usk beyond the settlement boundary.

Two grassland SINCs lie within the western half of the site. Otherwise, no other protected sites occur within the settlement. A small area of ASNW SINC abuts the south-west boundary, and a grassland SINC lies close to the settlement boundary.

Wern Fawr Woodland and a series of small watercourses (which flow into the Nant y Robwl) lie at the north of the settlement and connect with Chapel Lane Meadow grassland SINC. Nominally connected via watercourses with the railway (and its verges), this represents the most extensive route of connectivity through the settlement.

Two other mixed semi-natural habitat units also provide connectivity: Land West of Fairfield and Penperlleni grassland SINC plus adjacent woodland, and a woodland/watercourse unit near Ty-Llwyd Farm.

The main urban zone of Penperlleni appears to have few semi-natural corridors. Here the main corridor is a watercourse which flows into the Nant y Robwl at the northern edge of the settlement.

Summary – Identified habitat connections include:

1) **The railway's semi-natural verges** together with small watercourses provide a linear corridor through the settlement. It is further connected with Wern Fawr Woodland, small watercourses and Chapel Lane Meadow grassland SINC to create an extensive route of connectivity in the settlement. The watercourse flowing into the Nant y Robwl, represents the main semi-natural corridor through the main residential area of Penperlleni.

2) **Mixed semi-natural habitat units**. Land West of Fairfield grassland SINC and adjacent woodland, together with a woodland/watercourse network near Ty-Llywd farm represent the other main semi-natural habitat features in the settlement and may act as stepping stones for wildlife movement.

3) **Hedgerows** provide connections to the linear features listed above and interlink to hedgerow networks outside of the settlement, for example in the north east hedgerows forge a link between the railway verges and the settlement's field systems and beyond into the wider landscape. In the south

east of the settlement hedgerows provide potential wildlife corridors between small semi-natural habitat patches.

Connectivity with the wider landscape

Penperlleni is surrounded by a series of important ecological sites. ASNW SINCs are scattered around the settlement, with a higher density in the east and west. The River Usk SAC and SSSI is c1.5km to the east of the settlement and the Monmouthshire and Brecon Canal west of the settlement boundary. The next nearest SSSIs are Llandegfedd Reservoir 3km to the south and The Blorenge 5km to the north. An ASNW SINC straddles the south-east border of the settlement and Springfield grassland SINC lies in its close proximity. Wern Fawr Woodland extends beyond the northern boundary of the settlement and is located close to a series of other coniferous woodland units, including those around Goytre Wharf.

Small watercourses, hedgerows and the railway provide the most extensive linear corridors for movement of species in and out of the settlement.

Opportunities to strengthen existing connectivity

Strengthen the existing primary route of connectivity and overcome barriers.

1) Strengthen the robustness of the small watercourses which flow into the Nant y Robwl. Widen the semi-natural buffer where possible. This is the main corridor through the urban zone of Penperlleni.

2) Strengthen the railway corridor. Ensure tree lines and hedgerows are well connected and sensitively managed. Ensure sensitive management and extension of grassland verges. Investigate the improved connectivity of watercourses where they flow below the railway.

3) Ensure hedgerows are sensitively managed and well connected.

4) Ensure existing blocks of semi-natural habitat and protected sites are sensitively managed and their extent increased where appropriate.

Opportunities to enhance connectivity

Two opportunities are identified for enhancing habitat connectivity between sections of the primary route of connectivity. The first is to link the main railway and woodland corridor to the Land West of Fairfield grassland SINC and its adjacent woodland. The second is to link the main railway and woodland corridor with the woodland/watercourse unit near Ty-Llywd farm.

Further opportunities to form links between additional habitat patches (small groups of trees, woodlands that straddle the settlement boundary) and link them to the primary route of connectivity are identified. In the south east of the settlement this includes enhancing connectivity between small groups of trees

and Ynys-y-pica Wood and forging links between these groups and the railway line. Towards the centre of the settlement, the opportunity to link the railway corridor with Land West of Fairfield grassland SINC (and its adjacent woodland), via a small cluster of trees (Fairfield road) is highlighted.

At the eastern boundary of the settlement (near Pen-y-wern wood) an opportunity to link a standing water feature with the railway line is identified.

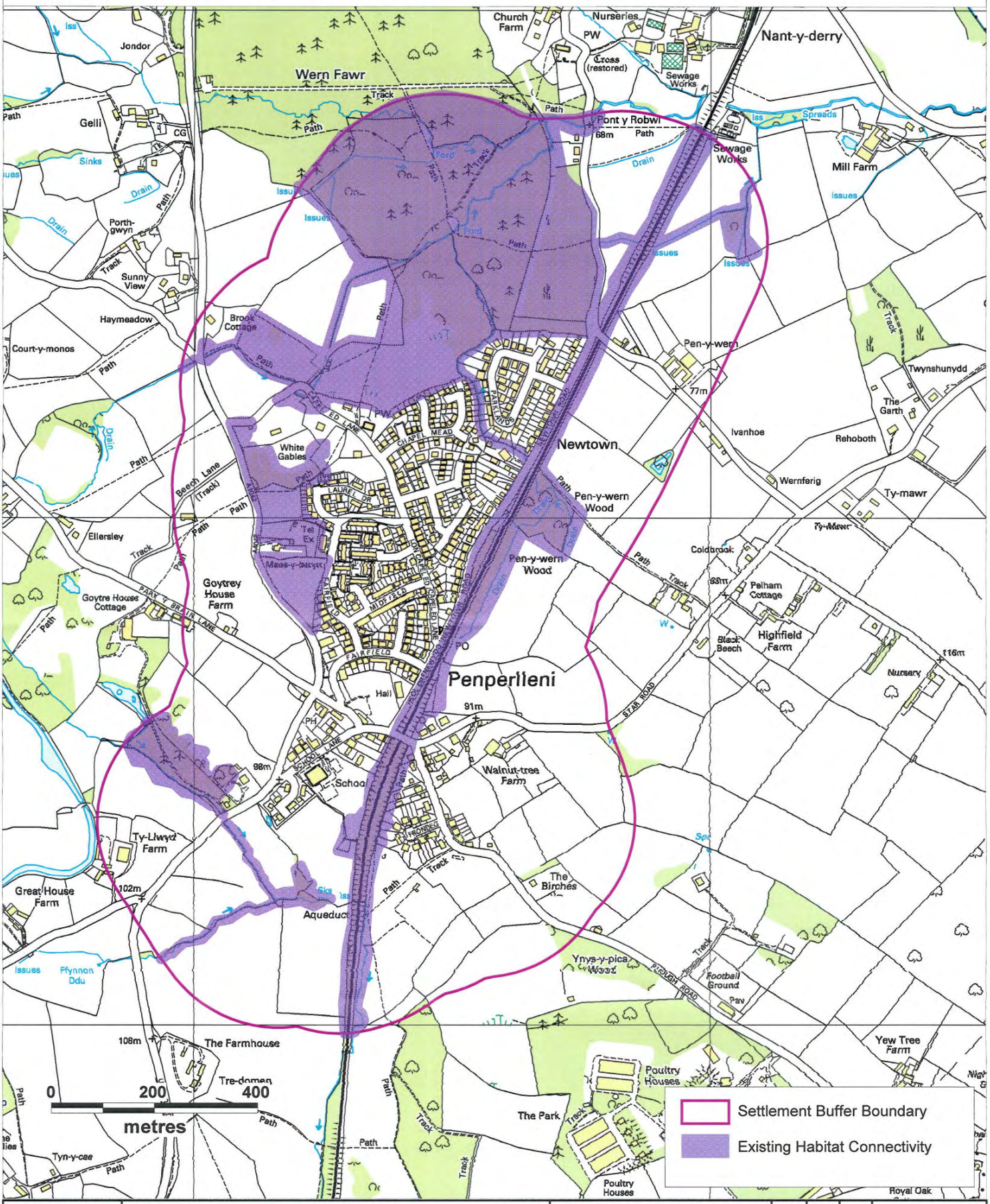
Otters and Watercourses

Small streams and drains represent the existing watercourses within the settlement. These connect outside of the settlement with the Monmouthshire and Brecon canal to the west and the Nant y Robwl in the north, which flows into the River Usk c1.5km to the east. Otters are known to use the River Usk and its tributaries and are a primary qualifying feature for its designation as a SSSI and SAC. Otter records are also known for the canal.

The main physical barriers to the potential movement of otters are represented by the railway, which running north-south through the settlement and beyond, means any otter would have to negotiate it if travelling between the two main watercourses in the area; the River Usk and the Monmouthshire and Brecon Canal.

Roads often represent a significant barrier to the movement of otters. In Penperlleni small watercourses are intersected by the A4042 Usk Road at two points, presenting a potential barrier to the movement of otters. Outside of the settlement the Nant y derry and Chain Bridge roads intersect the Nant y Robwl at a couple of points, representing potential barriers to otter movement along the brook to and from the River Usk.

Penperlleni: Habitat Connectivity Map



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Ecological Connectivity Assessment of Settlement in Monmouthshire		

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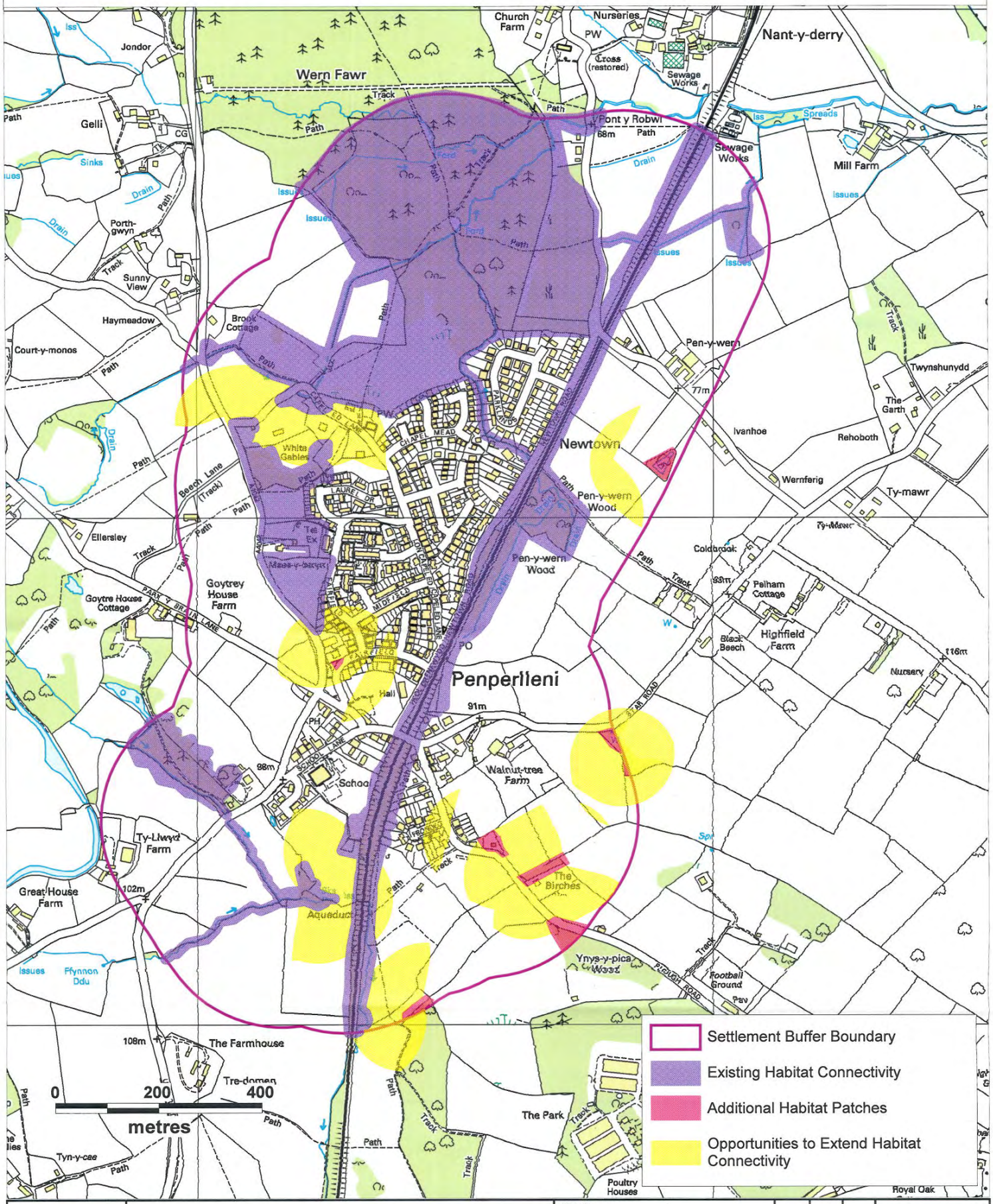
Penperlleni: Habitat Connectivity Opportunities Map



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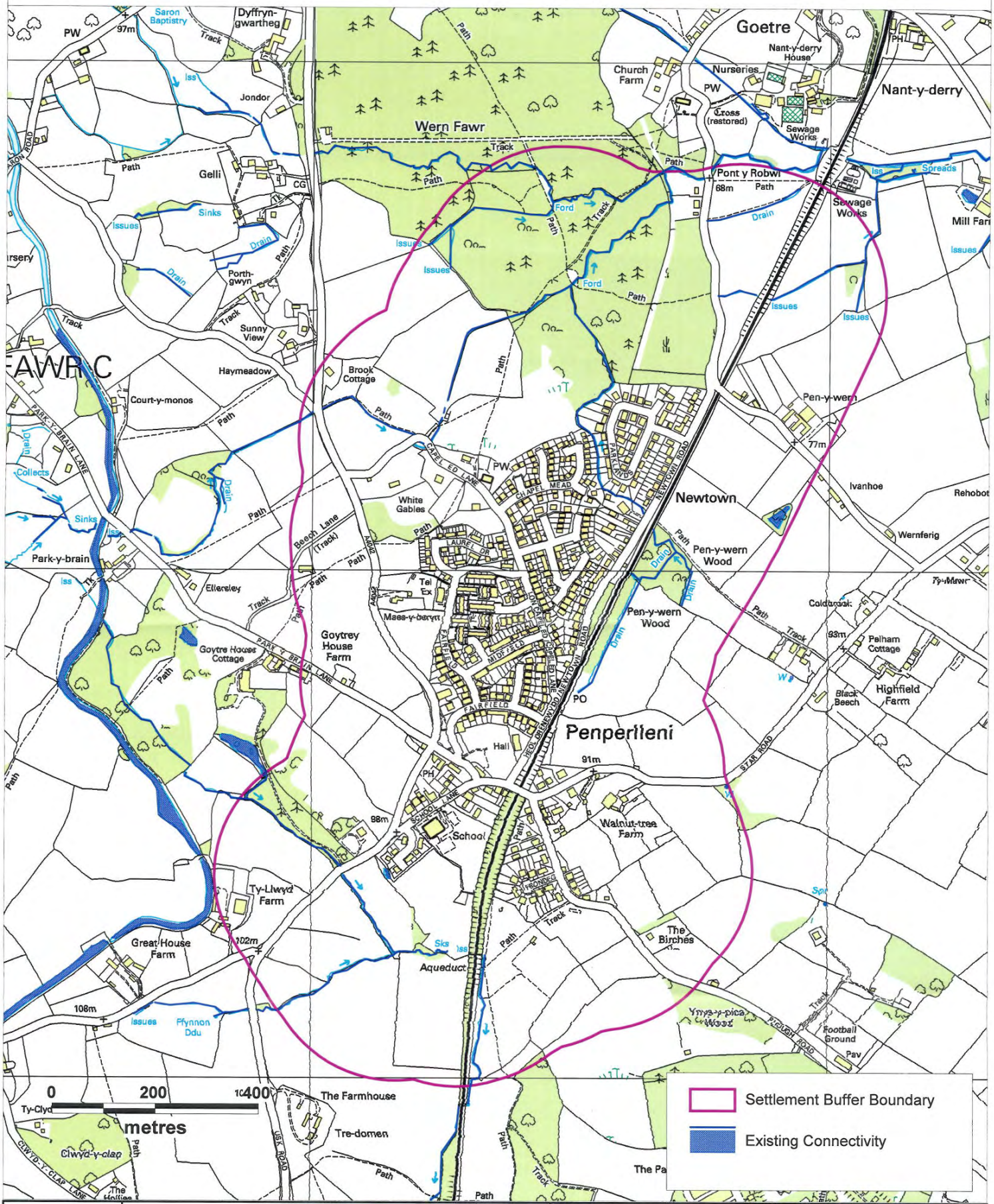
Penperlleni: Otters & Watercourses Connectivity Map



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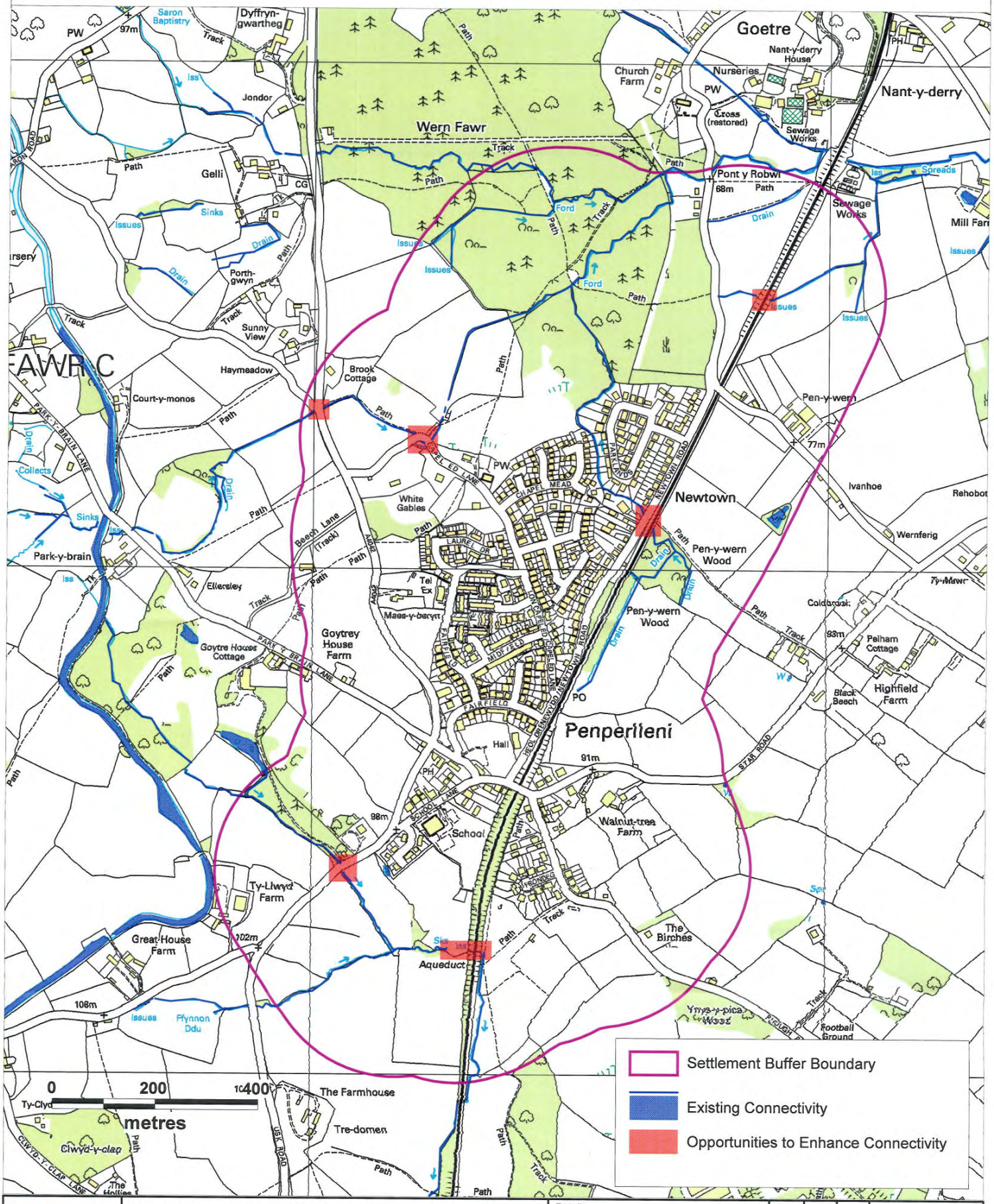
Penperlleni: Otters & Watercourses Connectivity Opporyunities Map



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5.2.8 Settlement 13: Usk

Existing habitat connectivity within the settlement

The small town of Usk is situated on the banks of the River Usk, to the north east of Newport. The River Usk is a site of both national and European Conservation importance (SAC and SSSI) and flows north to south through the centre of the settlement. In addition, the Olway Brook, a site of local conservation importance (SINC) passes into and out of the settlement at its north east edge, and a series of smaller watercourses and drains flow within the eastern half of the settlement. These are connected with each other and other semi-natural features. A dismantled railway runs east-west through the settlement running through a disused tunnel and over the River Usk on route through the settlement.

Other routes of existing connectivity that were identified are represented by mixed habitat blocks. To the north, Cockshoot wood ASNW SINC and adjacent semi-improved species-rich grassland form a unit further interconnected by a series of small watercourses. At the west of the settlement lies a band of ASNW woodland, stretching approximately north-south (and including Graig-yn-Allt SINC and Graig Foel SINC) and connected with small watercourses.

A further small piece of woodland and connected small watercourse is situated near the north east edge of the settlement, near Glen Oak House. The woodland here is continuous with a spur of ASNW outside the settlement.

The River Usk corridor and the interconnected dismantled railway represent the most extensive routes of connectivity through and out of the settlement.

Summary – Identified habitat connections include:

1) **The River Usk** is a significant corridor through the centre of Usk. It is accompanied by a narrow semi-natural corridor, sometimes including tree lines and scrub. The main urban zone of Usk is immediately to the east, and to the west it is flanked by the Caerleon Road. The corridor slightly widens at the north to include woodland to both sides and is further extended by drains which flow into the Usk.

2) **The dismantled railway** represents a second linear corridor through Usk. It is accompanied for much of its length by dense trees and scrub, however sections of it pass through tunnels and the A472 does divide the corridor into two in the west of the settlement. The corridor is further extended through its connection to small areas of woodland and groups of trees near Usk Castle, plus a pond and series of drains. The corridor also extends to include the tree lined verges of the A472 as it enters Usk from the east.

3) **Three semi-natural mixed habitat blocks** - At the north of the settlement lies Cockshoot Wood ASNW SINC and an adjacent semi-improved species-

rich grassland unit, further interconnected by a series of small watercourses. Also at the north near Glen Oak House, is a small piece of woodland connected to a small watercourse. The woodland here connects with a spur of ASNW SINC outside the settlement. At the west of the settlement lies a band of ASNW SINC, stretching approximately north-south (and including Graig-yn-Allt and Graig Foel) and interconnected to small watercourses.

4) **Hedgerows** are evident around many of the fields towards the perimeters of the settlement, providing local connectivity. They further extend the linear connectivity of the features above, for example hedgerows intersect at a number of points with both Graig-yn-Allt/Graig Foel woodland and the tree lined disused railway. In addition hedgerows line many of the minor roads within the settlement and interlink with hedgerow networks outside the settlement.

1) and 2) are connected and together provide the main linear route of connectivity through the settlement.

Connectivity with the wider landscape

The River Usk has huge ecological influence and together with its tributaries (including the Olway Brook) provides a far reaching route of connectivity between the settlement to the wider landscape and ecologically important sites. For example, it connects with the River Severn c18km to the south, a site of international conservation importance. The interconnected dismantled railway provides a further link to ecologically important sites for example Berthin Brook SINC and adjacent ASNW SINC.

Straddling the north east and west edges of the settlement, ASNWs provide a link to further ASNWs beyond the settlement. Lying close to the north and west of the settlement and radiating out are further scattered ASNW SINC units and some small grassland SINCs. Further away (7.5 km to the south west) lies the PAWS of Wentwood. The nearest SSSI (Llandegfedd Reservoir) is 3.5km to the west of Usk and 2.5km to the east are a series of grassland SINCs near GWT's Springdale Farm Reserve.

Opportunities to strengthen existing connectivity

Strengthen the existing primary route of connectivity and overcome barriers.

1) Strengthen the dismantled railway corridor. Ensure tree line and hedgerows are well connected and sensitively managed. Ensure sensitive management of grassland verges. Improve linkage of the disused viaduct with other nearby semi-natural habitats to further bolster corridors through the settlement

2) Strengthen the River Usk corridor, the most extensive semi-natural corridor in and out of Usk. Ensure a buffer of semi-natural habitat with adjacent fields and the built urban landscape and connect with near-by areas of semi-natural

habitat where possible. Extend this to include examination of the concentration of smaller watercourses in the east of the settlement.

3) Ensure hedgerows are sensitively managed and well-connected.

4) Ensure current blocks of semi-natural habitat and protected sites are sensitively managed and their extent increased where appropriate.

Opportunities to enhance connectivity

Opportunities are identified in the north east of the settlement to link different sections of the primary route of connectivity; these are to link the mixed habitat blocks around Cockshoot Wood ASNW SINC and Glen Oak House with the dismantled railway corridor.

A series of further opportunities are identified to build links between small additional habitat patches and the River Usk corridor, band of ASNW (Graig-yn-Allt SINC and Graig Foel SINC) and the dismantled railway corridor. Many of the opportunities involve forming links between small groups of trees on the outskirts of the main urban zone of Usk, and the River Usk to the west and dismantled railway to the north. Specific examples in the south of the settlement include linking a group of trees to the south of a nursery (on Baron Street) with the River Usk corridor, and linking Langates wood with Graig-yn-Allt ASNW SINC.

In the north opportunities include linking a group of trees and a pond at the end of Castle Oak Road, to the dismantled railway to the south and Cockshoot wood/semi improved grassland to the north.

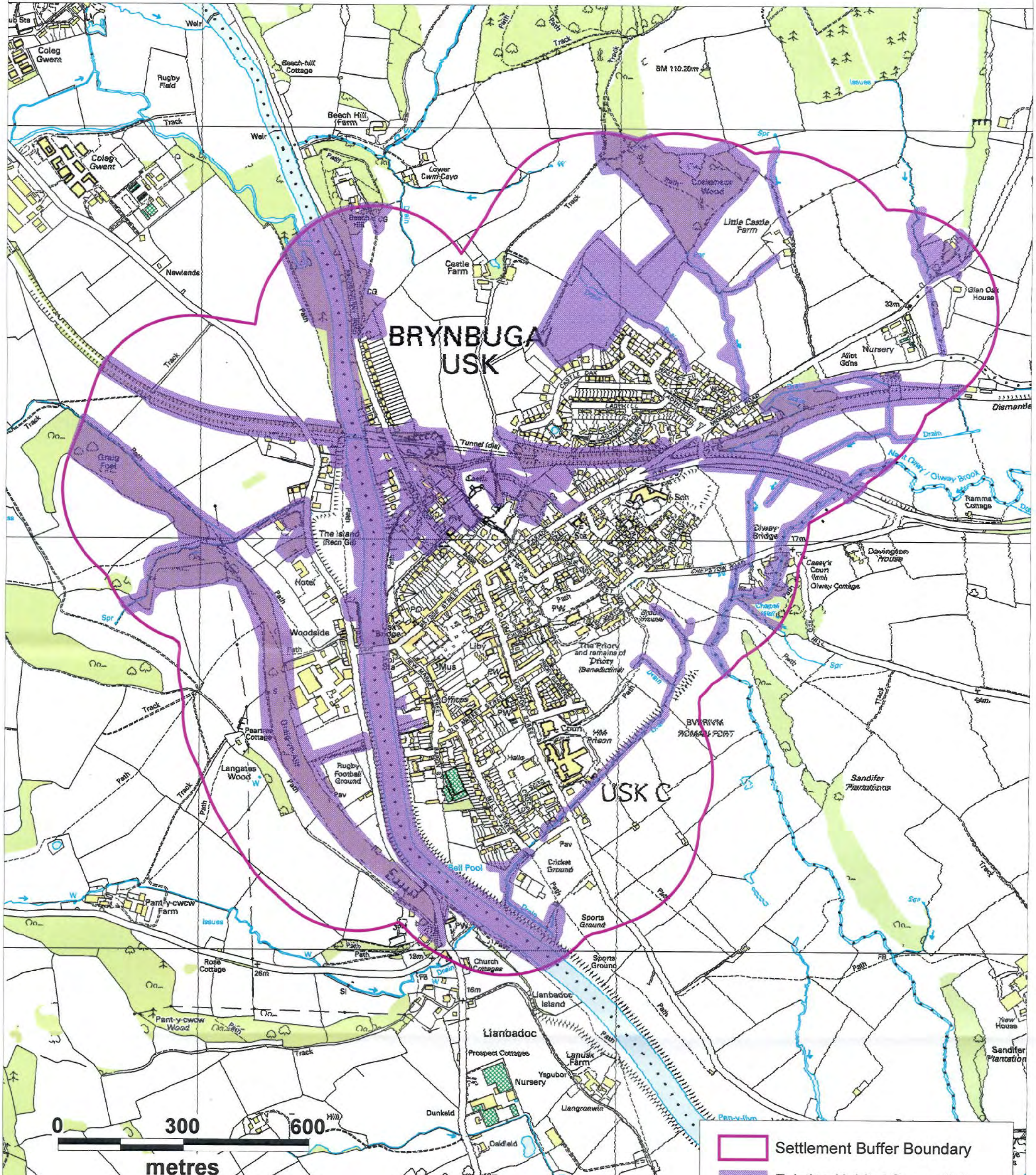
Great Crested Newts and Ponds

Pond density and connectivity is greatest in the eastern half of the settlement, where a cluster of connected ponds are situated in the Castle Oaks and Monmouth road area. These are connected to a further cluster of ponds in the north west of the settlement, which extend beyond the settlement buffer near Beech Hill Farm.

A smaller cluster of ponds lies at the south east edge of the settlement. An opportunity is identified to link these to the main cluster of ponds described above. The two pond clusters lie in close vicinity. In addition a single pond lies to the west of the River Usk. Again there is an opportunity to link this with the main cluster of ponds in the east of the settlement.

Further pond clusters are located around the settlement boundary with a particular concentration of three pond groups to the south/south west of the settlement near Llanbadoc. Opportunities to forge links between these individual clusters and also to pond groups within the settlement are identified. For example there is an opportunity to link the ponds south of Llanbadoc to the ponds to the east of Usk Prison.

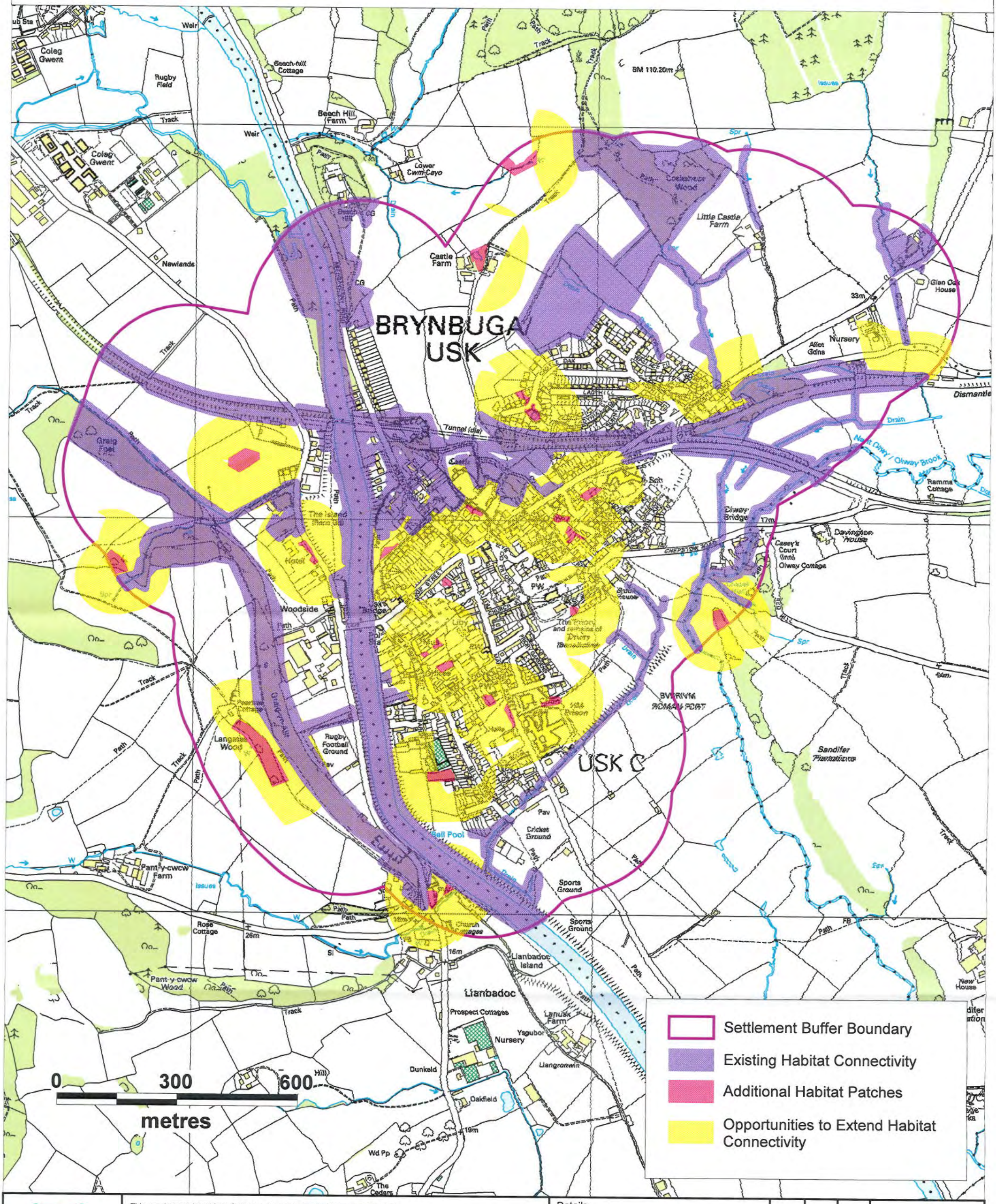
Usk: Habitat Connectivity Map



Details Usk: Settlement 13		
Drawn By Fry.D	Scale 1:9001	Date 23/04/2010
Ecological Connectivity Assessment of Settlement in Monmouthshire		

www.monmouthshire.gov.uk

Usk: Habitat Connectivity Opportunities Map



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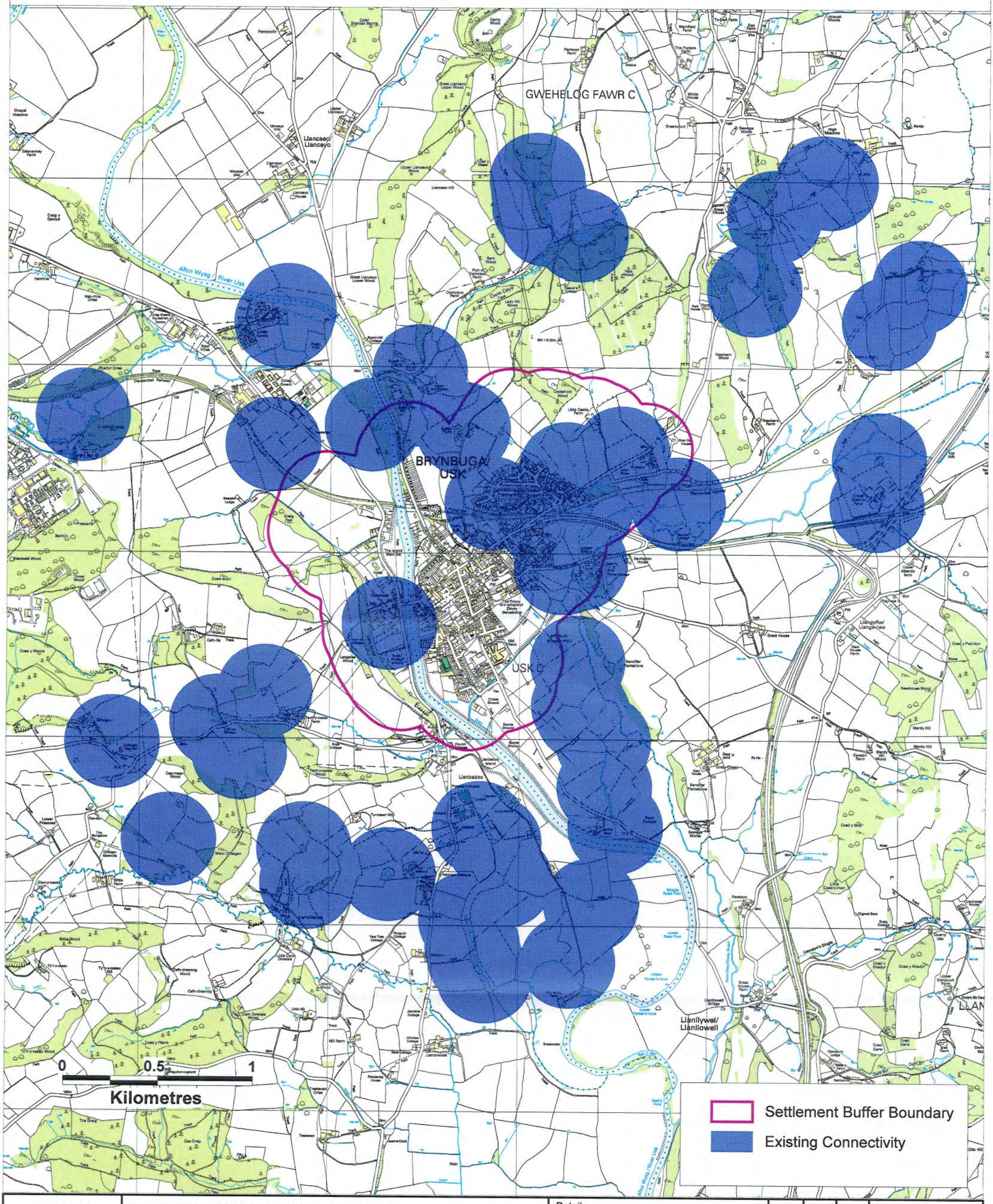
Drawn By: Fry.D	Scale: 1:9001	Date: 23/04/2010
Ecological Connectivity Assessment of Settlement in Monmouthshire		

www.monmouthshire.gov.uk

Usk: Great Crested Newt & Ponds Connectivity Map



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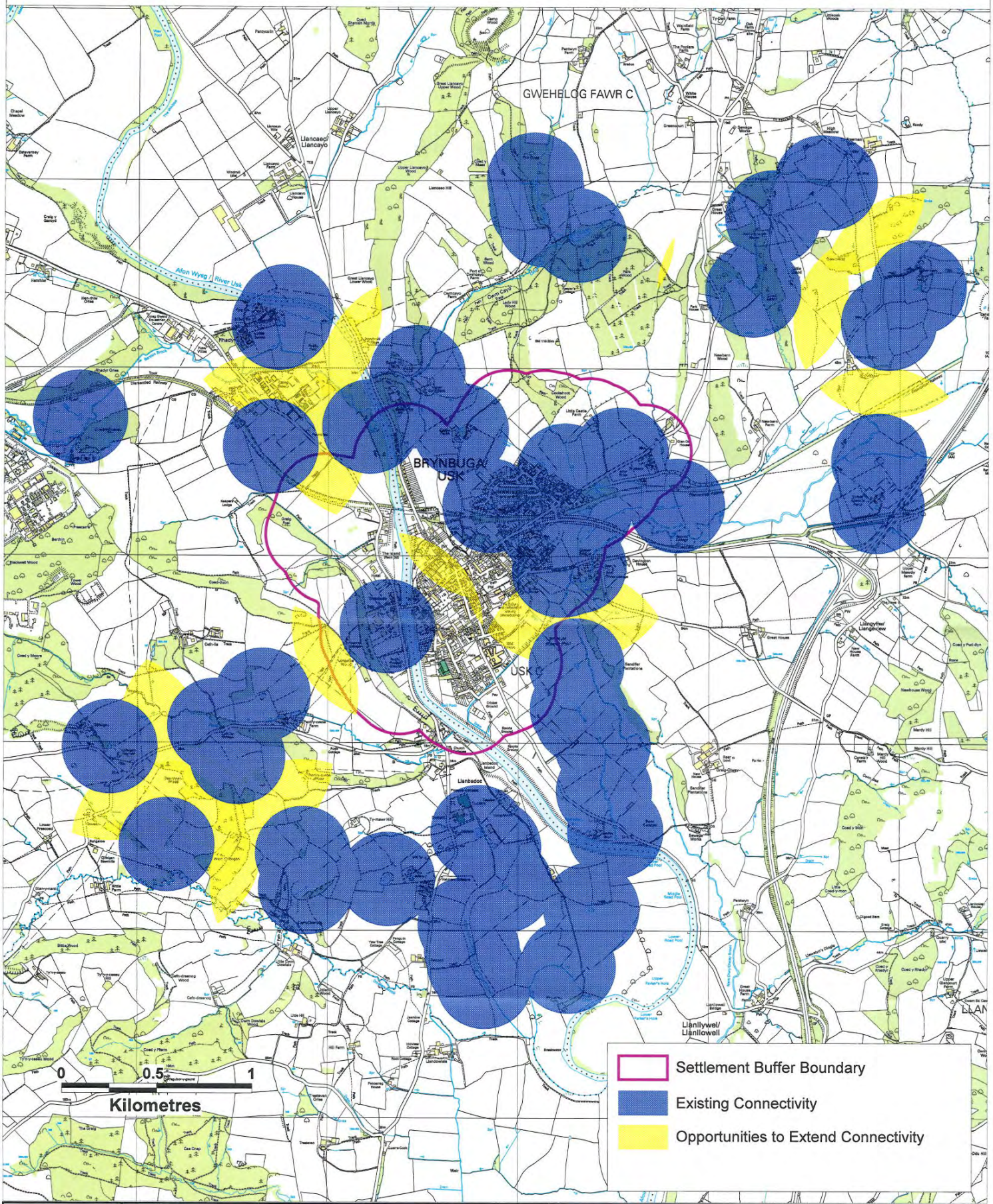
Ecological Connectivity Assessment of Settlement in Monmouthshire						

Usk: Great Crested Newt & Ponds Connectivity Opportunities Map



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Usk: Settlement 13		
Drawn By Fry.D	Scale 1:19000	Date 23/04/2010
Ecological Connectivity Assessment of Settlement in Monmouthshire		

www.monmouthshire.gov.uk

6. Recommendations

6.1 Management Recommendations

The priority semi-natural habitats in Monmouthshire that provided the focus for this study are described below, together with general management recommendations.

Hedgerows

Hedgerows form a distinctive part of our rural landscape and have historic significance as well as being important for wildlife. Hedgerows are protected by the Hedgerow Regulations[42] and are a UKBAP and Section 42 habitat[43]. A species-rich hedgerow will contain a greater variety of shrubs, trees and associated herbaceous species than a species-poor hedgerow, and is more likely to be older and support more fauna. Hedges that are not managed by laying or cutting become overgrown hedgerows. Hedgerows that have not been managed for some time develop gaps between the woody species and will eventually resemble a line of shrubs. Hedgerows provide habitat for wildlife such as breeding birds, small mammals and invertebrates. Hedges that are on top of banks provide basking areas and shelter for reptiles. Hedges are important in terms of ecological connectivity, as they enable many species to move from place to place. Bats, in particular, use hedgerows for navigation.

Hedgerow Management Recommendations:

- Plant gaps of species-poor hedgerows with a diversity of native species.
- Hawthorn and blackthorn typically make up 50% of native hedges and should form the main species in the hedgerow.
- The remaining 50% should be made up of a selection of traditional hedgerow species such as alder, field-rose, hazel, dog-rose, common dogwood, purple willow, sweet briar, rowan, oak and crab apple.
- Lay/coppice overgrown hedgerows, to restore structure.
- Cut hedgerows once every two years and as late as possible, preferably during January and February.
- Undertake management in rotation.
- Undertake hedgerow management outside main bird breeding season (March-August).
- Plant species-rich hedgerows where appropriate to provide biodiversity shelter and aid connectivity.

Semi-Improved Grassland

Semi-improved grassland is land that has been subject to some agricultural improvement in the past, but has been treated less intensively. The

[42] The Hedgerow Regulations (1997)
[43] As outlined in the Natural Environment and Rural Communities (NERC) Act (2006).

biodiversity interest of this type of grassland is variable, so it is divided into species-rich and species-poor to indicate nature conservation importance. Unimproved grassland, which has not had any seeding or enrichment, is now very rare. Unimproved grassland is species-rich and of high biodiversity interest. Both unimproved grassland and species-rich semi-improved grassland are considered to qualify as Lowland Meadow which is a UKBAP and S42 habitat. Monmouthshire is a Welsh stronghold for species-rich grasslands, and many SINCs have been designated for their grassland interest. Semi-improved species-rich grassland is not confined to agricultural fields and examples of species-rich grassland can be found in churchyards, parks and gardens, and on roadside verges.

Semi-Improved Grassland Management Recommendations:

- Employ sensitive management such as meadow or pasture management depending upon the past management of the site and current species interest.
- Pasture management involves lightly grazing in spring and summer by sheep or cattle year after year.
- Grazing levels should be adjusted to enable a variety of sward heights from short to slightly tussocky, and for some flowering and seed setting to take place.
- Overgrazing should be avoided to prevent too much bare ground which is colonized by weedy species. Undergrazing should be avoided which can lead to dominance by coarse grasses and scrub.
- Traditional meadow management involves cutting for hay in late July. Removing the cuttings helps to remove nutrients and prevents rotting down creating thick matted vegetation. Grazing after the hay cut helps to keep coarse, palatable grasses in check and light trampling creates pockets of bare soil for seed germination.
- Fence to enable management.
- Avoid application of artificial fertilizers.
- Enhance boundaries with semi-natural features, e.g. hedgerows, dry-stone walls.
- Control invasive plant species.
- Identify importance for grassland fungi (e.g. waxcap fungi) and fauna.

<u>Watercourses</u>

Watercourses include rivers, streams, ditches and canals. Rivers and streams are generally natural features; ditches tend to be man-made. Rivers and streams are UKBAP/S42 habitats, whereas ditches and canals are not. Riparian habitat refers to vegetation associated with a flowing watercourse, usually along the banks. Watercourses and riparian habitats are important for a range of species, including fish, otter, water vole, white-clawed crayfish, invertebrates and birds such as dipper and kingfisher. Monmouthshire has many watercourses of high biodiversity value, namely the Wye and Usk SACs and their tributaries[44].

[44] JNCC, 2009

Watercourse Management Recommendations:

- Encourage semi-natural buffers around watercourses.
- Management of mature pollards like willow.
- Avoid culverting, and seek to open existing ones.
- Control pollution.
- Manage ditches in rotation.
- Control invasive species, e.g. Himalayan balsam, giant hogweed, Japanese knotweed.

Woodlands

Woodland is classified as deciduous woodland and coniferous woodland. Deciduous woodland[45] comprises of trees that lose their leaves in winter and coniferous woodland is made up of mostly of evergreen trees. Woodland described as semi-natural is made up of mostly native species and has not been planted. Plantation woodland is planted, usually for forestry, and is normally made up of coniferous trees. Designated ancient woodland is woodland defined as ASNW – areas that have been wooded since at least 1600. ASNW is listed on the Gwent Inventory of Ancient Woodland[46]. The inventory also highlights sites of PAW, which may still retain characteristics of ASNW. Most deciduous woodlands qualify as UKBAP/S42 habitats, with the most common types in Monmouthshire being lowland mixed deciduous woodland or upland mixed ash woods. Woodlands are important for birds, mammals, invertebrates, lichens and fungi, as well as characteristic plant species such as bluebell. The biodiversity of woodland depends on several factors, but generally older, deciduous woodland in larger patches has a higher value.

Woodland Management Recommendations:

- Fence areas of woodland.
- Include a buffer strip around woodland to help protect woodland.
- Woodland planting with native and local provenance tree and shrub species.
- Carry out woodland management appropriate to the site's history and species composition e.g. maintenance of woodland rides, coppiced areas.
- Ensure continuity of management.
- Degraded woodland can be restored through careful woodland management.

Ponds

Ponds are UKBAP Priority and S42 habitats. Many ponds have been lost to poor management, development and changes in agriculture and the ponds that remain often have little value for biodiversity. Ponds support a wide variety of plants and invertebrates, as well as amphibians and fish. Ponds can

[45] Also referred to as broadleaf woodland
[46] Nature Conservancy Council, 1989

be natural or man-made, for example on post-industrial sites, permanent or seasonal, and all types can have high biodiversity. It is important that they have a clean water source to offer maximum opportunities for wildlife. Provision of a clean water course is an essential consideration when creating new pond complexes.

Pond Management Recommendations:

- Re-create and restore existing ponds to build on the local network.
- Maintain and protect the water source and include a buffer around the pond, as many species rely on the surrounding vegetation as well as the water-body.
- Pond management depends on the nature of the site – some will need de-silting or the control of vegetation.
- Create pond complexes or multiple pools rather than a single water body. This should include additional features such as shallow ponds and scrapes and a large deeper pond.
- Within complexes, include both permanent and seasonal ponds. Ponds do not need to hold water all year round and temporary ponds also provide important habitats for wildlife. This will attract invertebrates and birds such as lapwing.
- Create underwater bars and shoals to benefit aquatic plants.
- Avoid complete over-shading by trees.
- When designing new pond complexes consider future problems such as how the pond will be used by people and animals[47].
- Ponds can form part of SUDS, bio-filtration systems, or cooling systems. They also help with flood mitigation and alleviation.

Mature Trees, Veteran Trees and Scrub

Mature trees, veteran trees and street trees all feature in Monmouthshire's LBAP. Trees and shrubs provide habitat for many species such as birds, bats, invertebrates, fungi, mosses and lichens. Badgers often dig setts at the base of trees. Shrubs provide a shelter for mammals and birds. Generally, native trees and older trees are more valuable for wildlife. Dead trees are also important for wildlife; standing dead wood is particularly valuable for fungi and invertebrates such as beetles. In an amenity sense, trees are useful for screening, noise and dust suppression, reducing air pollution and place making. Older trees (also known as veteran trees or ancient trees) often have historic and cultural value. These trees are defined as 'a tree that is of interest biologically, culturally or aesthetically, because of its age, size or condition'[48]. They typically have very large girths, a lot of dead wood in the canopy, and burrs and cavities in the trunk. They often occupy prominent positions in the landscape. Identifying veteran trees is subjective, as different tree species have different life-spans.

Mature Trees, Veteran Trees and Scrub Management:

[47] Million Ponds Project Toolkit, 2009
[48] Natural England 2000

- Ensure any necessary work to veteran trees is preceded by a professional bat survey.
- Retain appropriate areas of scrub as part of habitat mosaic, e.g. significant to breeding birds, dormice.
- If trees and shrubs need to be removed then should only take place outside of the bird breeding season, and replaced with native species of local provenance at a ratio of 1:1 or greater.
- When planting trees use appropriate native species of local provenance.
- Consideration should be given to aftercare, such as leaf or fruit dropping, and also the height and space a tree will occupy as it matures.
- A variety of species, grouped together, and integrated with other landscaping such as hedges or shrubs offers higher biodiversity value.

6.2 Further Assessments

European Protected Species

Site specific studies should be undertaken to accurately identify the location of species and important populations.

Hedgerows

A detailed hedgerow assessment should be considered to identify those hedgerows which are of high ecological and corridor value in the context of sustaining and improving ecological connectivity.

Bats

Bats are known to use linear features for foraging and rely on their consistency in the landscape. In Monmouthshire, species such as common pipistrelle (*Pipistrellus pipistrellus*) are widespread, but the area is a stronghold for the lesser horseshoe bat (*Rhinolophus hipposideros*). Two SACs in Monmouthshire have been designated to protect this rare species[49]. Greater and lesser horseshoe bats are known to feed, roost and breed within a variety of semi-natural habitats in Monmouthshire. It can be assumed that they may be located within any of the settlements; this may include roost sites in veteran trees, agriculture and domestic buildings, utilisation of hedgerow and watercourse corridors for foraging and navigation, foraging over insect-rich grassland.

Determining a method for examining habitat connectivity within Monmouthshire with direct relevance to bats would be a valuable addition to the assessment of connectivity given here.

[49] JNCC, 2009

Habitat Surveys

An up-to-date Phase 1 field survey of habitats and assessment of their conservation value within the settlements would ideally be recommended, to verify existing habitat data sets. An up-to-date SINC assessment of any site should be undertaken to validate the conservation value of any area under focus for development. This would include a detailed assessment by survey of connectivity features. This is especially important for grassland habitats which are vulnerable to management changes.

CCW Econet Tool Kit

It is timely that whilst undertaking this assessment, CCW have released details of The Econet Toolkit – A GIS approach to Ecological Connectivity.[50]. This will provide a useful tool for the further assessment of ecological connectivity and identification of connectivity opportunities across Monmouthshire, helping to ensure resources are best directed at opportunities which best benefit biodiversity.

Direction of Resources

Assessments of Ecological Connectivity can help to direct funding to those conservation schemes on the ground which are of maximum benefit to biodiversity.

[50] CCW 2009

7. Caveats and Constraints

This assessment of ecological connectivity is subject to a number of inherent constraints that are summarised in this section of the report. These caveats do not necessarily limit the value of the assessment undertaken but should be evaluated and understood within the LDP process to ensure that information within the report, and MapInfo GIS layer files are correctly interpreted.

7.1 MapInfo GIS

Using MapInfo GIS, Base Habitat Layers are best viewed when the 'zoom figure' is not less than circa 4.0km (i.e. map scale: 1cm=0.08km).

Aerial images were used by and large to map the physical limits of base features. The boundaries as defined on aerials are sometimes incompatible with those defined on the OS layers.

GWT's MapInfo GIS package used makes use of Raster images of OS maps. This limits the resolution and quality of background OS based maps when exported as JPEGs/printed out. It also means no 'GIS snap tool' is available for quick and accurate mapping in line with OS mapped features.

Final, good quality copies of the maps were printed out in-house by Monmouthshire County Council for insertion into the hard copies of this report. If you are accessing the electronic version of this report, better quality maps are available on request to Biodiversity & Ecology Officer, Countryside Service, MCC, County Hall, Cwmbran. NP44 2XH

7.2 Use of LDP Site Assessment Project Data

The LDP Site Assessment Project (LDP-SAP) is a separate project. The associated LDP-SAP report should be read in conjunction with the Connectivity Project Report presented here.

To ensure the data for the LDP-SAP helped inform this project, yet did not detract from those other parts of the settlements not surveyed in 2009, the Phase 1 Vegetation Assessment MapInfo GIS Layer was the main reference point.

In particular, this layer was used to help identity semi-improved species-rich grassland areas. If grassland within an LDP site was recorded as semi-improved species-rich, it was included on the Semi-improved Grassland Habitat Base Layer.

LDP-SAP Phase 1 codes were given regard and Target Notes reviewed. However, the data associated with veteran trees and species-rich hedgerows was not used for the mapping of the connectivity study base layers. A comprehensive assessment of the quality of these features for the rest of the

settlement is not available. Use of LDP-SAP data for these features may have compromised consistency.

7.3 Ground Truthing & Field Work

The assessment of connectivity within each settlement boundary was largely undertaken through an assessment of aerial photographs supplemented by reference to existing relevant data sets and connectivity features (as listed in Figure 3).

Limited validation of key features through ground truth survey was possible outside of the qualitative site assessments undertaken in the LDP Site Assessment Project. Aerial photographs[51] provide a functional means of assessing linkage of linear habitat features on a settlement scale, and proved to be a highly effective tool in the assessment process.

7.4 The Assessment Process

- This assessment focuses on the major linkages in the settlements and links with the wider landscape. The assessment should not be used to detract from habitat connectivity at a very local level, e.g. where a field network is enclosed by well connected hedgerows, otherwise unconnected in the settlement. The buffering process used to identify connectivity opportunities could be employed to identify other smaller scale opportunities.

- The Existing Habitat Connectivity layer should be considered a summary layer. It highlights primary routes of connectivity based on the collective viewing of base habitat layers. Whilst a defined method has been followed this remains a single assessment of connectivity and by its nature involves a degree of subjectivity. Existing habitat value and any potential for enhancement or bolstering the resource and strengthening connectivity with other high value biodiversity areas should be considered in all planning decisions.

- All examples of semi-natural features identified in the base layers are of importance and should be given regard even if not specifically highlighted in this study. For example, any example of a hedgerow or a watercourse should be given regard, even if it is not an integral part of the major linkages identified in this study. Retaining existing hedgerows, enhancing their quality through sensitive management, and improving hedgerow linkages should be advocated in all development cases.

- The assessment of ecological connectivity outlined here focuses on the physical component of connectivity and takes a broad, simple approach focusing on physical linkages of priority semi-natural habitats and sites

[51] On-line sources including Google Map and wheresthepath.com

within Monmouthshire. The assumption is made that if semi-natural habitat is better connected (i.e. less fragmented), biodiversity will be more viable. Whilst some species may rely on 'good' connectivity of a particular habitat, the lines of existing habitat connectivity do not distinguish between habitat type and it is assumed that connectedness of semi-natural habitat *per se* is valuable.

- Connectivity is difficult to define and is different for different species, which vary in their minimum habitat resource requirements, and distances travelled to find new resources. Ecological processes, genetic and species flux will also take place outside of the main physical semi-natural corridors identified in this study

- The Habitat and Species Connectivity Opportunities Maps represent theoretical opportunities; they give no consideration to features which may represent irresolvable barriers on the ground, for example built structures such as roads, buildings and central urban zones or unfavourable habitat. For example the Great Crested Newt opportunities map makes the assumption that ponds are in favourable condition and that suitable habitat lies in between ponds within a pond cluster. Species may move more freely around the settlement through the open countryside to reach different parts of settlement rather than moving through its core.

- The assessment focuses on linear connectivity. In a fragmented landscape, the major routes of connection are often represented by linear features such as watercourses, tree lines and road verges. Such features provide important biodiversity corridors for species movement and are in many cases the primary examples of connectivity. This should not detract from connectivity represented by physically unconnected but clustered units of semi-natural habitat which may act as 'stepping stones' for species movement, or be important for aerial connectivity.

- The quality of linear features is not directly assessed in this study. All existing hedges and watercourses are considered to be of value for connectivity. Scrub and hedgerow links are important throughout Monmouthshire for the movement of species such as dormice and bats which are known to use these linear features. They are of particular importance where there are known records, however absence of records doesn't mean absence of species, therefore ensuring good condition and connectivity of these extensive linear features is important in all cases.

- The habitat quality of railway and roadside verges is not verified within this study.

- Hedgerows are excluded from the Opportunities to Extend Habitat Connectivity layer; hence there may be examples whereby hedgerows provide an existing connection between blocks of otherwise separate semi-natural habitat.

- This is not an all inclusive assessment of existing biodiversity interest. The connectivity assessment focuses on four priority habitats/features agreed in conjunction with MCC. This should not detract from other features which are of importance to wildlife and its movement but are not highlighted in this assessment for example veteran trees, dry-stone walls, rough grassland and field margins. In particular gardens are not considered in this assessment. They can provide invaluable habitat for wildlife and aid connectivity within urban zones.

- Grassland SINCs - within the settlement reports 'Grassland SINCs' refers only to currently designated grassland SINCs, not sites that are of SINC quality but await approval by the Monmouthshire SINC panel, i.e. semi-improved species-rich grassland sites identified to be of SINC quality within the LDP-SAP are not referred to as SINCs in this report.

7.5 Mapping of Semi-Natural Habitats & Available Data Sets

Ponds: The mapping of ponds is not comprehensive. Water feature mapping was based on OS mapped features, scale 1:10,000. Whilst mapped ponds for the great crested newt assessment were verified by MCC against more detailed pond maps, this was not undertaken for all settlements.

Linear Features: The border of roadside and railway verges is followed where it can be identified on aerials. It is a 'symbolic layer'; its main purpose is to pick up linear features not picked up on the other base layers.

Hedgerows, Woodlands and Tree Lines: Aerial maps were the main reference point. Judgment was required to decide whether a linear woody feature constituted a woodland strip/hedgerow (drawn as a 'polyline') or a woodland/group of trees (drawn as a 'polygon'). Efforts were focused away from the main residential zones of settlements, where accurately mapping the many small sections of hedgerows and trees would be difficult. Woodland *per se* was mapped and therefore the assessment gives no consideration to different woodland types (e.g. broadleaf and coniferous) and their relative nature conservation interest.

Semi-Improved Grassland: The Semi-improved Grassland Layer focuses on examples of semi-improved species-rich grassland. These were mapped using LDP-SAP and GGI data. The GGI visited 95% of those species-rich grasslands in Monmouthshire highlighted in the CCW Phase 1 Survey of Wales. The GGI and associated SINCs therefore provided the focus for mapping of grassland sites. However, this assessment is not comprehensive; other semi-improved species-rich sites are likely to exist and some grassland not highlighted for its botanical interest may still be of significance to certain species for example small mammals and invertebrates.

Habitat Base Layers: These should not be treated as an absolute assessment of areas of biodiversity interest. Ground truthing was very limited. Mapping

relied heavily on existing data sets and aerial photos. It is important to realise that habitats vary significantly with season and may be altered from this original recorded status. Therefore a full up-to-date SINC assessment of any site should be undertaken to validate the conservation value of any area under focus for development. This would include a detailed assessment by survey of connectivity features.

Species Data: The assessment of species connectivity is limited by the disparity and age of data which is available. Data and information from SEWBReC or other anecdotal sources are clearly historic and often from a single season. It is important to realise that species vary significantly with season and may be altered from this original recorded status. An up-to-date and appropriate survey is vital to inform any changes to a site's use or management.

7.6 Changes in Contractual Deadlines and Content

Since its inception the project has undergone much development, with changes in methodology and scope of the MapInfo GIS component of the contract. Any re-definition of project timescales or contract delivery was overcome by consensus through documented discussions between MCC and GE.

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Welsh Office (1996) Technical Advice Note (TAN) 5: Nature Conservation and Planning (1996)
http://wales.gov.uk/desh/policy/planning/tan5/tane.pdf?lang=en

9. Glossary

9.1 Abbreviations

ASNW: Ancient Semi-Natural Woodland, as recorded in Gwent's Ancient Woodland Inventory (Nature Conservancy Council, 1989)

BAP: Biodiversity Action Plan

CCW: Countryside Council for Wales

Ecological Connectivity: Primary route of connectivity:
Defined in this assessment as physical connectivity between 2 semi-natural habitats and/or a linear habitat.

EU/UK Protected Species: species protected by the EU Birds Directive (1979, as amended), the EU Habitats Directive (1991, as amended) or the UK Wildlife and Countryside Act (1981, as amended)

EU Protected Sites: sites designated as Special Protection Area (SPA), RAMSAR Site or Special Area of Conservation (SAC)

GCN: Great crested newt

GE: Gwent Ecology, the consultancy company of Gwent Wildlife Trust

GGI: Gwent Grassland Initiative (Lowland Grasslands Project led by Gwent Wildlife Trust, 2005-2008)

GIS: Geographic Information System

GWT: Gwent Wildlife Trust

GWT Reserve: Nature Reserve managed by Gwent Wildlife Trust

LBAP Habitats: those listed as Local Priority Habitats in the Monmouthshire Local Biodiversity Action Plan

LBAP Species and Habitats: species and habitats listed as Local Priority Species or Habitats in Monmouthshire's Local Biodiversity Action Plan, as listed on BARS

LDP: Local Development Plan

LDP-SAPP: LDP Candidate Site Assessment Project

Local Protected Sites: sites designated as Local Nature Reserve (LNR) or Site of Importance for Nature Conservation (SINC)

LWS: Local Wildlife Site – a SINC where the owner has been consulted and management advice is provided

MapInfo GIS: Geographic Information system

Mature and Veteran trees: Natural England defines a veteran tree as '*a tree which, because of its great age, size or condition is of exceptional value culturally, in the landscape or for wildlife*'

MCC: Monmouthshire County Council

Monmouthshire LBAP Species: species listed as Local Priority Species in the Monmouthshire Local Biodiversity Action Plan

NNR: National Nature Reserve

PAW: Planted Ancient Woodland

Phase 1: Field Methodology for assessing habitat types as described in Handbook for Phase 1 survey – a technique for environmental audit, JNCC, 1993

SAC: Special Area of Conservation

Semi-natural: habitat which has been subject to some agricultural improvement or other management by humans in the past, but which retains some of its natural character.

SEWBReC: South East Wales Biodiversity Records Centre

SINC: Site of Importance for Nature Conservation – a planning term to indicate sites of local importance

SPA: Special Protection Area

SSSI: Site of Special Scientific Interest – UK protected site

UDP: Unitary Development Plan

UK Priority Habitats: UK Biodiversity Action Plan Priority Habitats

UK or Wales Priority Species: species listed as UK Biodiversity Action Plan Priority Species or Section 42 Species of Principal Importance for Conservation of Biological Diversity in Wales (through the Natural Environment and Rural Communities Act, 2006)

UKBAP/S42 Species and Habitats: species and habitats listed as being of conservation concern either as UK Biodiversity Action Plan Priority Species or Habitats, or Species or Habitats of Principal Importance for Conservation of

Biological Diversity in Wales, under Section 24 of the NERC Act, 2006. Excludes species listed as 'research only' in the UKBAP

UK Protected Sites: sites designated as National Nature Reserve (NNR) or Site of Special Scientific Interest (SSSI)

Urban Zone: defined broadly in this assessment to be the main built sector within a settlement, i.e. where buildings, private residences are concentrated

WAG: Welsh Assembly Government

Wales Priority Habitats: those on the Section 42 list of Habitats of Principal Importance for Conservation of Biological Diversity in Wales

9.2 Glossary of Habitats

Allotments and Gardens
Allotments and gardens feature in Monmouthshire's LBAP under 'The Built Environment'. They are variable in their biodiversity value. Many can be invaluable for invertebrates, small mammals and slow worms, and they often incorporate wildlife features such as ponds and mature trees (see other entries). Gardens that are beneficial for wildlife are declining because of the trends for tidy, low-maintenance gardens and the paving of gardens to create parking spaces. This trend has exacerbated surface water drainage problems and may have contributed to the decline of species such as hedgehogs.

Brownfield
A type of brownfield land – open mosaic habitats on previously developed land is a UKBAP/S42 habitat. Brownfield land is a general term for land that has previously been developed. This term encompasses a wide variety of sites and former uses, and a resulting variety of biodiversity value. Although there is a presumption towards redeveloping brownfield land, Planning Policy Wales excludes '*previously developed land the nature conservation value of which could outweigh the re-use of the site'.* Generally, sites that are more varied topographically and have a mosaic of different habitats are likely to have a higher biodiversity value. These sites are likely to support birds, small mammals and reptiles, and often support rare invertebrates.

Buildings and Hard-standing
Buildings, both modern and traditional, are featured in the Monmouthshire LBAP under 'The Built Environment'. Although buildings can be perceived as devoid of wildlife, they can provide habitat for nesting birds and roosting bats, as well as invertebrates, mosses and lichens. Buildings are associated with gardens and some types of grassland.

Coniferous woodland – see Woodland

Deciduous woodland – see Woodland

Ditches – see Riparian Habitat, Rivers, Streams and Ditches

Gardens – see Allotments and Gardens

Grassland

A type of grassland, Lowland Meadow, is a UKBAP and S42 habitat. Grassland has been classified in several ways. Improved grassland is grassland that has been enriched or seeded for agricultural purposes. It has little biodiversity interest, although there may be more species in the field margins where the improvement has been less intensive. Semi-improved grassland is land that has been subject to agricultural improvement in the past, or has been treated less intensively – it is often referred to as semi-natural grassland. The biodiversity interest of this type of grassland is variable, so this has been divided into species-rich and species-poor to indicate nature conservation importance. Unimproved grassland, which has not had any seeding or enrichment, is now very rare. Unimproved grassland is species-rich and has a high biodiversity interest. Both unimproved grassland and species-rich semi-improved grassland are considered to qualify as Lowland Meadow.

Species-rich grasslands (both semi-improved and unimproved) are important for the flowers that they support, which are often rarities, and for invertebrates and fungi. We have lost 97% of unimproved grassland in England and Wales in the last 50 years. Monmouthshire is the welsh stronghold for species-rich grasslands, and many SINCs have been designated for their grassland interest. It is important to note that species-rich grassland is not confined to agricultural fields – examples of species-rich grassland can be found in churchyards, parks and gardens, and even on roadside verges.

Grazing Marshes

Coastal and floodplain grazing marshes are UKBAP and Section 42 habitats. This habitat is unusual in that it is man-made, consisting of grazed pasture that is drained by ditches. The ditches support a wide variety of invertebrates, whilst the wet grassland is important for wading birds like snipe and lapwing. The best examples of this habitat type in Monmouthshire are found on the Gwent Levels. Across the UK, grazing marsh is threatened by inappropriate management, development and pollution.

Hedgerows

Hedgerows form a distinctive part of our rural landscape, so they often have historic significance as well as being important for wildlife. Hedgerows are protected by the Hedgerow Regulations 1997 (see Annex 5 on Policy and Legislation), and are a UKBAP and S42 habitat. Hedgerows can incorporate mature trees (see separate note). A species-rich hedgerow will contain a greater variety of shrubs, trees and associated herbaceous species than a species-poor hedgerow, and is more likely to be older and support more fauna. Hedges that are not managed by laying or cutting become overgrown hedgerows. Hedgerows that have not been managed for some time develop

gaps between the woody species and will eventually resemble a line of shrubs.

Hedgerows provide habitat for lots of wildlife, particularly breeding birds, small mammals such as dormice and hedgehogs, and invertebrates. Hedges that are on top of banks provide basking areas and shelter for reptiles. Hedges are also important in terms of ecological connectivity, as they enable many species to move from place to place. Bats, in particular, use hedgerows for navigation. Wales lost 25% of hedgerows between 1984 and 1990, through direct removal and neglect[52].

Improved Grassland – see Grassland

Mature Trees, Veteran Trees and Shrubs

Mature trees, veteran trees and street trees all feature in Monmouthshire's LBAP. Trees and shrubs provide habitat for many species – birds, bats, invertebrates, fungi, mosses and lichens all use trees. Badgers often dig setts at the base of trees. Shrubs provide a shelter for mammals as well as birds. Generally, native trees and older trees are more valuable for wildlife. Dead trees are also good for wildlife; standing dead wood is particularly valuable for fungi and invertebrates such as beetles. In an amenity sense, trees are useful for screening, noise and dust suppression, reducing air pollution and place making. Older trees (also known as veteran trees or ancient trees) often have historic and cultural value. These trees are defined as 'a tree that is of interest biologically, culturally or aesthetically, because of its age, size or condition'[53]. They typically have very large girths, a lot of dead wood in the canopy, and burrs and cavities in the trunk. They often occupy prominent positions in the landscape. Identifying veteran trees is subjective as different tree species have different life-spans.

Ponds

Ponds are UKBAP Priority and S42 habitats. Many ponds have been lost to poor management, development and changes in agriculture and the ponds that remain often have little value for biodiversity. Ponds support a wide variety of plants and invertebrates, as well as amphibians and fish. Ponds can be natural or man-made, for example on post-industrial sites, permanent or seasonal, and all types can have high biodiversity. It is therefore important to survey ponds to assess their importance for biodiversity (usually by analysing the invertebrate population) and to ascertain whether protected and S42 species are present.

Railway Verges and Embankments

Disused railway lines are featured in the Monmouthshire LBAP under Boundary and Linear Features, but all embankments have some biodiversity value. One of their main benefits is to function as wildlife corridors, improving ecological connectivity. Embankments share many qualities with brownfield habitats, and provide habitat for reptiles, invertebrates, birds and small

[52] UKBAP Partnership, 1995
[53] Natural England 2000

mammals. Wider, more established embankments are likely to support more biodiversity.

Riparian Habitat, Rivers, Streams and Ditches/Reens

Rivers and streams are UKBAP/S42 habitats, whereas ditches and canals are not. Riparian habitat refers to vegetation associated with a flowing watercourse, usually along the banks. Rivers and streams are generally natural features; ditches (or reens) tend to be man-made. Watercourses and riparian habitats are important for a range of species, including fish, otter, water vole, white-clawed crayfish, invertebrates and birds such as dipper and kingfisher. Monmouthshire has many watercourses of high biodiversity value, namely the Wye and Usk SACs and their tributaries[54]. However, many invasive and non-native species such as Himalayan balsam and giant hogweed are associated with rivers and streams.

Watercourses can be protected during development by fencing a buffer on either side. Measures to prevent pollution of the watercourse or its source and maintain water flows will need to be put in place. Restoring degraded watercourses can be difficult if the source of the problem is upstream, but in many cases improvements can be made by eradicating invasive species and managing riparian vegetation. Naturalising canalised or culverted watercourses can give biodiversity enhancements. Structures such as otter holts and kingfisher banks can be made. Created watercourses can contribute to flood risk management, SUDS and filtration systems, as well as being nature conservation features.

Rivers – see Riparian Habitat, Rivers, Streams and Ditches

Coastal saltmarshes

Saltmarsh is an intertidal area between the land and sea, made up of the upper, vegetated portions of intertidal mudflats, between the mean high-water neap tides and mean high-water spring tides[55]. This habitat is usually restricted to sheltered locations in estuaries, saline lagoons, behind barrier islands, at the heads of sea lochs, and on beach plains. Saltmarsh contains a variety of vegetation communities and is of particularly important for invertebrates[56]. It also offers an important feeding resource for wading birds and wildfowl, whilst providing a nursery sites for several species of fish.

Coastal saltmarsh is listed on the UKBAP/S42 list. The Severn Estuary is an internationally important area in Wales containing large areas of coastal saltmarsh. As such, the Severn Estuary is designated a SAC due to the coastal saltmarsh habitats that it contains (e.g. intertidal mudflats and sandflats). It is also designated as a SSSI.

[54] JNCC, 2009
[55] UKBAP, 2009
[56] UKBAP, 2009

Scrub
Scrub refers to a habitat that is essentially the early stages developing woodland. Scrub is normally a mixture of immature trees and shrubs, with rambling or climbing species such as bramble and dog rose. Scrub is often seen to be a low value habitat, but it can be beneficial to birds, small mammals and invertebrates. The value of scrub often depends on its composition and location. Scrub is usually of higher biodiversity value when it forms a mosaic with grassland or heath habitats, or when it connects or buffers woodland. Scrub containing a variety of different species will be of greater biodiversity value.

Semi-improved species-rich grassland – see Grassland

Semi-improved species-poor grassland – see Grassland

Streams - see Riparian Habitat, Rivers, Streams and Ditches

Unimproved Grassland – see Grassland

Veteran Trees – see Mature Trees, Veteran trees and Shrubs

Wetlands – Marshes, Bogs and Swamps
The UKBAP Priority habitat classification of wetlands depends on complex factors such as soil type and water source, as well as the detail of the vegetation community. As the majority of wetland habitats feature in the UKBAP/S42 list in some way, we have grouped them together for simplicity. For the purposes of this report, a wetland or marsh is an area of habitat where the water table is close to the soil surface and characteristic species are present. Wetlands support a wide range of protected and priority species, such as invertebrates, wading birds and amphibians, but wetland ecosystems are sensitive to changes in water flow and water quality, leading to many being degraded or lost.

Woodland
Woodland has been classified as deciduous woodland (also referred to as broadleaf woodland) – comprising mostly trees that lose their leaves in winter, or coniferous woodland – comprising mostly evergreen trees. Woodland described as semi-natural is woodland, made up of mostly native species, that has not been planted. Plantation woodland is purposely planted, usually for forestry, and is normally made up of coniferous trees. Designated ancient woodland is woodland defined as ASNW – areas that have been wooded since at least 1600. ASNW is listed on the Gwent Inventory of Ancient Woodland (Nature Conservancy Council, 1989). The inventory also notes sites of PAW, which may still retain characteristics of ASNW.

Most deciduous woodlands qualify as UKBAP/S42 habitats, with the most common types in Monmouthshire being lowland mixed deciduous woodland or upland mixed ashwood. Woodlands are important for birds, mammals, invertebrates, lichens and fungi, as well as characteristic plant species such

as bluebell. The biodiversity of woodland depends on several factors, but generally older, deciduous woodland in larger patches has a higher value. All woodlands should be subject to further survey to determine their value and assess for potential to support rare and protected species.

10. Appendices

10.1 Appendix 1: Project Development

Project Development

GE's original tender agreement was amended accordingly in March 2009 in view of a revised list of settlements and the statement of requirement clarified by a meeting between MCC and GWT on 26th June 2009.

Project Staff

The early part of the project was overseen by Gemma Bodé, GWT Conservation Manager, who also carried out some of the early desk based and project development work until mid June 2009. Thereafter the assessment and reporting was undertaken by Rebecca Price, Wildlife Projects Officer.

Julian Branscombe, GWT Chief Executive Officer (CEO), acted in a quality assurance capacity, and oversaw the Project until his departure in early July 2009. Thereafter the Project was managed by Dr Richard Park, GWT's new CEO.

Quality Assurance

Quality Assurance checks were undertaken by a combination of GWT's CEO as Project Manager, an experienced project mentor and other GWT staff including the administrative team and on her return from maternity leave Gemma Bodé.

10.2 Appendix 2: Policy & Legislation

The Conservation (Natural Habitats, &c.) Regulations, 1994 (as amended) (also referred to as the Habitats Regulations, 1994)
This legislation transposes into UK law and implements the EC Habitats Directive (92/43/EEC) and the EC Birds Directive (79/409/EEC) which themselves derive from the Bern Convention and the Bonn Convention). It makes provision for protecting certain species and habitat types, and the designation of sites that make a significant contribution to their conservation. These sites are known as Special Areas of Conservation (SACs). SACs are part of the European network of protected sites known as the Natura 2000 network.

'European protected species' (as used in this report) are defined as those species listed on Schedules 2 and 4 of the Habitats Regulations. It is an offence to:

- deliberately to capture or kill a wild animal of a European protected species
- deliberately to disturb any such animal
- deliberately to take or destroy the eggs of such an animal; or
- to damage or destroy a breeding site or resting place of such an animal

It is an offence deliberately to pick, collect, cut, uproot or destroy a wild plant of a European protected species.

The Wildlife & Countryside Act 1981 (as amended)
This legislation provides protection for certain species, and also makes provision for the designation of Sites of Special Scientific Interest (SSSIs), Special Protected Areas (SPAs) and Marine Nature Reserves (MNRs). There are also certain provisions regarding National Parks and public rights of way. The amendments include the Countryside and Rights of Way (CROW) Act, 2000, the NERC Act, 2006 and a five-yearly review of schedules 5 and 8.

'Species protected under UK legislation' (as used in this report) are defined as those species listed under Schedules 5 and 8 of the Wildlife & Countryside Act, 1981 (as amended) or the Protection of Badgers Act, 1992. Generally, the Wildlife & Countryside Act 1981 makes it an offense to:

- intentionally kill, injure or take any wild bird (with certain limited exceptions) or any wild animal listed in Schedule 5
- take, damage or destroy the nest or an egg of any wild bird (with certain limited exceptions)
- damage or destroy, or obstruct access to, any structure or place which any wild animal included in Schedule 5 uses for shelter or protection
- disturb any Schedule 5 animal while it is occupying a structure or place which it uses for shelter or protection
- intentionally pick, uproot or destroy any wild plant included in Schedule 8

We have listed breeding birds collectively, but it should be noted that there are special penalties and additional offences relating to birds listed in Schedule 1.

It is an additional offence to intentionally or recklessly disturb the adults or dependent young while they are in and around their nest. These birds are not listed separately, so future surveyors and developers should be alert to the possibility of these species being present on sites.

Species which are protected under Section 9.5 of the Wildlife & Countryside Act 1981 are protected from sale only and are therefore not included.

Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (as amended)
These regulations set out the Environmental Impact Assessment (EIA) process, lists those developments that require EIA.

The Hedgerow Regulations 1997
These regulations make it an offense to remove or destroy certain hedgerows without permission from the local planning authority. The authority is required to assess the 'importance' of the hedgerow using criteria relating to the age, local significance, associated features and number of woody species. There is a strong presumption that hedgerows qualifying as 'important' will be protected.

The Countryside and Rights of Way Act 2000 (The CROW Act)
This act introduces the concept of open access land and improves the rights of way legislation. It also amended the Wildlife and Countryside Act, giving greater powers for the protection and management of SSSIs and strengthening the protection of certain species. It supports the UKBAP process by placing a duty on government departments and the National Assembly for Wales to have '*have regard… to the purpose of conserving biodiversity'* in accordance with the Convention of Biological Diversity 1992.

The Natural Environment and Rural Communities (NERC) Act 2006
As well as making provision for the formation of Natural England and the Commission for Rural Communities, this act builds on the CROW Act by placing the duty to '*have regard… to the purpose of conserving biodiversity'* on all public authorities. Section 42 of the NERC Act requires the Welsh Assembly Government (in consultation with the Countryside Council for Wales) to publish a list of species and habitats which are of principal importance for the purpose of conserving biodiversity (now known as the Section 42 or S42 list), and to take steps to further their conservation.

Planning Policy Wales 2002 (PPW)
This guidance sets out the land use planning policies of the Welsh Assembly Government. Particularly, it emphasises the importance of sustainable development, and outlines key principles such as the respect for environmental limits, the precautionary principle and the polluter pays. In its objectives, it states that planning policies and proposals should contribute to the protection and improvement of the environment. The natural heritage chapter sets out detailed policies relating to protected sites and species, the BAP process, ecological connectivity and mitigation and enhancement.

Technical Advice Note (TAN) 5 Nature Conservation 1996
This guidance gives more detail regarding the protection of statutory sites, non-statutory sites and biodiversity outside of protected areas. There is also guidance relating to protected species, commons and the role of the Countryside Council for Wales. This TAN was updated in 2006, but has not yet been formally adopted. The revised TAN contains additional guidance relating to the planning process, EIA, and BAP priority species and habitats.

The Section 42 (S42) list
Under the NERC Act, the Welsh Assembly Government is obliged to produce and publish a list of species and habitats which are of principal importance for the purpose of conserving biological diversity in Wales. The list will be reviewed on a regular basis.

The UK Biodiversity Action Plan (UKBAP)
The UKBAP is Government's response to the Convention on Biological Diversity (1992). It lists priority species and habitats (grouped into broad habitat types) together with their status, trends, threats and action to be taken to conserve them and improve their status. Progress against the UKBAP targets is reported every three years.

The Monmouthshire Local Biodiversity Action Plan (LBAP)
Local Biodiversity Action Plan Partnerships, usually consisting of representatives of the local authority, statutory bodies, voluntary sector and the local community, work together to identify local priorities and help to deliver the objectives of the UKBAP. The Monmouthshire LBAP identifies these local priorities and actions that the LBAP partnership can take to improve their status and deliver UKBAP targets.