Lichfield District Nature Recovery Network Mapping


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DRAFT REPORT

Staffordshire Wildlife Trust 2019

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1. Executive Summary

Staffordshire Wildlife Trust were commissioned by Lichfield District Council to carry out a strategic assessment of the districts biodiversity and habitat networks. This document outlines the existing picture of the districts nature network and describes key locations where habitats may be created or enhanced to contribute to nature's recovery (the Nature Recovery Network), as well as delivering against objectives set out in national planning policy legislation.

Existing data, previous biodiversity opportunity mapping, along with local, regional and national landscape designations and projects were taken into in this assessment methodology.

The methodologies developed aim to deliver against national policies and are used in conjunction with the Department for Environment Food and Rural Affairs biodiversity metrics 2.0 (beta test version) to carry out a strategic broad scale district level spatial assessment of the 'quality components' described in the metric. This included:

1. Habitat distinctiveness
2. Strategic significance (of habitat areas)
3. Habitat connectivity

By using the results above and specific habitat connectivity modelling software it has been possible to define Habitat Connectivity Opportunity (HCO) areas based on habitat types. This is an important next step in identifying areas which possess existing good habitat connectivity and where there is potential for future habitat creation or restoration to contribute to a more successful nature recovery network.

The HCO areas are described in terms of their key opportunities, threats, key species and other habitats which they support along with any potential 'add-on' benefits (e.g. ecosystem services) which could be derived from having well-connected diverse habitat networks contributing to a healthy nature recovery network.

The opportunity map is not static and as physical habitats change on the ground and are subsequently mapped and monitored, the map itself will evolve with these updates. The opportunity areas themselves are where work to enhance habitats can be focussed, where the opportunity to get the greatest benefits lies.

The results of the updated Nature Recovery Network closely reflect what was originally shown in the biodiversity opportunity assessment, within the Biodiversity & Development Supplementary Planning Document 2016. Analysis and opportunity areas mapped within the nature recovery network completed as part of this study are are to a fine scale and based around a more robust defensible methodology that can more clearly deliver against National Planning Policy Framework and Planning Policy Guidance objectives, as well as those likely to emerge as outlined in the Environment Bill (House of Commons, 2019).

2. Statutory requirement for a Nature Recovery Network

Staffordshire Wildlife Trust were commissioned by Lichfield District Council to carry out a strategic assessment of the districts biodiversity and habitat networks, to form part of an evidence base in order to ensure biodiversity is an integral part of policy development.

The commission required phase one habitat survey, habitat connectivity analysis and mapping and Local Nature Recovery Mapping. Whilst these are district studies they will provide a complement to form an integral part of the evidence base for the new Local Plan for Lichfield District (2018 -2040). These elements will enable the district to address the requirements articulated within para 170 and para 174 of the National Planning Policy Framework 2019 - To provide for the protection and support enhancements to the districts natural environment through the identification, mapping and safeguarding the components and enabling connectivity, interpretation and integration of the natural resources to deliver overall net gain for biodiversity.

It must be noted that since previous opportunity mapping was carried out over 10 years ago, there have been huge changes both in the knowledge and practical assessment and planning of landscape ecology as well as more statutory obligations for LAs to consider how to protect, enhance and restore biodiversity and the services that it provides.

Key stimulus in updating spatial environmental objectives were documents such as the Making Space for Nature: A review of England's wildlife sites and ecological networks report by Lawton et al. (2010), the government's 25 Year Environment Plan (2018) and most recently The Environment Bill.

The fundamental principles behind the Making Space For Nature report are for England's ecological network to be 'more, bigger, better and joined' to ensure the survival of species in the face of multiple pressures at a range of scales. The government's 25 year environment plan puts more impetus on the statutory need to consider the conservation of biodiversity and ensure that it is effectively accounted for through the spatial planning system and the recently published DEFRA Environment Bill.

The emerging Environment Bill sets out environmental principles directed toward the restoration and enhancement of nature and plots a course for how these should be achieved through Nature Recovery Network mapping at a local level ('Local Nature Strategies') and will be a key document in driving the way that these networks are developed and delivered.

Additionally, updated guidance through the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019) and Planning Practice

Guidance (PPG) (Ministry of Housing, Communities and Local Government, 2019) have all served to put more emphasis the protection and conservation of nature and our natural resources through spatial planning, providing further justification for the need to have a Nature Recovery Network in place to create a roadmap of where these enhancements could and should go. This coupled with the emergence of mandatory biodiversity net gain provision. The Biodiversity Metric 2.0 has been revised, which provides a means of assessing changes in biodiversity value (losses or gains) brought about by development and changes in land use management. The metric is habitat based and gives consideration to improved ecological connectivity. Habitat opportunity maps are designed to be used in conjunction with Biodiversity Metric 2.0 but can also be used to both inform the metric and target the location and application of future ecological enhancements contributing to a functional nature recovery network.

3. Review of previous biodiversity opportunity mapping assessments

Prior to the commencement with any novel and innovative methods of spatially assessing and targeting opportunities for the enhancement of biodiversity, it is important to review the existing methods to ensure that new methods:

1. Can work in conjunction with previous methods where appropriate to provide additional detail which compliments the objectives and results of existing methodologies.
2. Are more appropriate than existing methods or provide standalone detail which can be used as evidence in its own right, additional to that of other methods.

The previous biodiversity opportunity mapping assessment carried out for Lichfield District (appendix I) still forms part of the districts evidence base via the Biodiversity & Development Supplementary Planning Document 2016. The previous opportunity assessment was reviewed and used as a benchmark to compare the results of the updated methods and models used, as part of the new nature recovery network assessment.

The previous methodologies used for biodiversity opportunity mapping in the county were based wholly on the local expert knowledge and stakeholder engagement via practical mapping exercises. Stakeholders and local experts were asked to highlight areas geographically that they saw as priorities for specific habitat and species conservation within a local authority (LA) area. The results of this were sense checked by Staffordshire Wildlife Trust, using available environmental data synthesized into a combined opportunity map and report, which defined spatial landscape areas and detailed conservation priorities within each LA area. The resulting map was effective in that by using expert knowledge, alongside ecological data, as opposed to purely relying on available datasets, it was possible to produce an opportunity map with zero white space (areas of a map which have no information). This something which is crucially important to inform decision making on a broad scale and to bring forward a nature recovery network.

It was concluded that whilst new methodologies can clearly provide a level of additional detail, local expert knowledge was still vital to provide credibility and justification to the use of any standalone spatial analyses and metrics. For this opportunity mapping exercise, a range of spatial analyses have been carried out, which in previous iterations were either not used or were not available. Crucially, the input from local experts and stakeholders continues to drive the mapping. This provides the all-important justification and ratification of the methods, to ensure that they are meaningful, delivering an accurate and comprehensive coverage of the study area.

4. Existing evidence base review

Gathering a robust evidence base is the vital first step to inform the assessment of opportunities to enhance habitats, without an evidence base there would be no way of producing or justifying meaningful opportunity areas or assessing ecosystem service potential. An inventory of available datasets is one way of bringing together an evidence base forming a platform on which to carry out further analysis.

4.1 Available environmental datasets

A list of relevant Geographic Information Systems (GIS) datasets available for use in completing the mapping assessment was provided by the local authority, these are listed in appendix A.

A further comprehensive list of datasets has been published by the Natural Capital Committee (2017) which were also considered for use in in the practical mapping work.

Additionally, datasets held by Staffordshire Ecological Record (SER) were identified as being of importance for the mapping work (some of these datasets are the same as those identified in appendix A, which have previously been provided to the local authority by SER through a service level agreement).

Using the data held by SER and SWT along with publicly available datasets accessible either through an Open Government License (OGL) or through Creative Commons licensing identified in the Natural Capital Committee workbook it was possible to bring together a comprehensive inventory of datasets for review.

Many of the datasets in the inventory are raw or primary data generated directly from information gathered from either desk based or field surveys and remote sensing.

The identification of the coverage and quality of a local authority's environmental dataset inventory provides the baseline from which to begin further work to analyse how it can be protected and enhanced to continue to provide both public and further environmental benefits. By aggregating and using all of the datasets in conjunction it is possible to build a composite assessment of the biodiversity within an area without any white space

4.2 Phase 1 habitat mapping via aerial photography interpretation

Part A of the scope of the consultant brief was to conduct a mapping exercise in order to identify 'the location of habitats of conservation importance through the completion of a Phase 1 habitats study for parts of the district'. The parts of the district subject to Phase 1 habitat mapping were areas of the district where there was no existing Phase 1 habitat data available, i.e. 'white space'.

Due to the size of the study area the Phase 1 mapping exercise was completed via a desk based methodology, manually assessing the white space against aerial photograph imagery in a GIS package by going 'field-to-field', mapping habitats that could be seen from the aerial photographs. Staff experienced in both on the ground and aerial interpretation habitat survey were used to complete the mapping, however no ground-truthing was carried out so accuracy and confidence of the digitised habitat data is subject to limitations (see section 4.3 for full data limitations).

The completion of this mapping exercise has resulted in a complete* Phase 1 habitat dataset for the local authority area. This dataset is a composite of habitat data from a wide range of ages.

A breakdown of the extent of the Phase 1 habitats dataset can be found in appendix B

4.3 National Character Areas in Lichfield District

National Character Areas (NCAs), defined by Natural England are sub-divisions of the country based on a combination of landscape, biodiversity, geodiversity and economic activity, these follow natural boundaries as opposed to more conventional political boundaries, for a map of the NCA areas in the district see appendix J.

The NCAs were considered in the nature recovery network mapping to ensure that priorities identified as part of the mapping were aligned to landscape national priorities identified in the respective NCA, taking into account factors such as landform, geology, soils, agriculture and key habitats and species.

Each of the NCAs has a summary and description of the natural and cultural features behind its definition along with the associated key facts, changes, threats and opportunities related to each of the individual NCAs.

Natural England have produced profile documents for each of the NCAs which can be found online at: https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles

The majority of the district falls under NCA 67 Cannock Chase and Cank Wood covering the south-western and central areas. A small part of the north of the district falls within NCA 68 Needwood and South Derbyshire Claylands. The North-east/east of the district is covered by NCAs 69 and 72 Trent Valley Washlands and Mease/Sence Lowlands respectively.

Priority conservation targets within NCA 67 are focused on conserving and expanding the area of lowland heathland, woodlands, open mosaic habitats and parklands as well as facilitation connections into the Birmingham and Black Country area. This area therefore is a focal area for the conservation and connectivity of rare habitats such as Lowland Heath through this mapping exercise.

* There may be small gaps in habitat data arising from digitising error or difficulty of creating a seamless fit based on existing data and newly created data.

NCA 68 priorities include the conservation of woodlands, trees and hedgerows as well as important areas of flood plain and small river networks.

The conservation priorities of NCAs 69 and 72 are both focused on conserving and improving both the cultural and environmental heritage of the respective landscapes, however the priorities from an ecological perspective in this area are focused toward the ecological improvements surrounding the nominative watercourses, their floodplains and associated riparian habitats. Two landscape scale conservation projects fall within NCA 69, the Transforming the Trent Valley (TTTV) Project and the Central Rivers Initiative (CRI), Lichfield District Council are partners in both of these projects.

4.4 Minerals Safeguarding Zones in Lichfield District

A large proportion of the district is within a mineral safeguarding zone which both presents challenges and opportunities in planning for nature conservation.

There is a need to consider minerals safeguarding zones in the nature recovery network mapping as these areas present both challenges and opportunities from a nature conservation perspective. Whilst the nature recovery network mapping is not spatially aligned on the minerals safeguarding zones, nor did it drive the mapping it is important to recognise that that these areas could potentially have a huge impact on the nature recovery network in future, either positively, negatively or both and where overlaps exist between the maps, there is opportunity to deliver multiple outcomes.

Whilst the likelihood is that much of the safeguarding area will never undergo any mineral extraction, planning any developments within them must be considered to ensure that this will not prevent mineral extraction on potential future extraction sites.

It is possible that high quality habitats may be losted as a result of mineral extraction, a mineral safeguarding zone may also provide protection to important habitats by protecting them from other types of developments. Whilst it is always best to avoid the loss of habitats and improve the diversity of the existing landscape, any ecological impact of mineral extraction can be negated through careful planning and ensuring that a suitable minerals restoration plan for the site is in place which recreates and expands the area of habitat on a like-for-like basis in the case of losing high quality habitats. Post extraction habitat restoration should be guided by the nature recovery network map to create habitats which will most suitably contribute to habitat connectivity within the landscape. In doing this it is possible for mineral extraction sites in the long term to actually benefit to the creation of a diverse and well-connected landscape providing further justification to not avoiding these areas when planning for nature conservation.

When considering planning for nature conservation for example through nature recovery network mapping such as this, mineral safeguarding zones cannot be excluded from the mapping exercise, land within the safeguarding zone may never be worked for minerals in the long term but could be of huge value in terms of contributing to diverse well connected

habitats and landscape either if no mineral extraction were to occur or through well planned sympathetic habitat restoration which may lead to more diverse habitats in the long term.

4.5 Data used and limitations

It is important to determine the limitations of any datasets identified to ensure that the best possible dataset(s) are used to give the best outcomes for connectivity mapping.

A number of factors can influence whether a dataset is suitable, for example age of the data and whether the data is in a format which can easily and readily be interrogated are crucial in deciding which datasets should be used.

Following a data review the combined habitat map produced during the earlier stages of this was used as a primary baseline from which as this represented the most complete habitat dataset for the area and would easily work with the preferred methodologies to generate the desired technical outputs detailed in sections 5-7.

Several datasets were used in the production of the Nature Recovery Network mapping, justification on their use and relevant limitations can be found in appendix C.

A full inventory of available datasets has been collated (appendix D) where each dataset was allocated a ‘confidence’ rating based on that particular datasets desirability and reliability which helps to justify a hierarchy of use i.e. where there is commonly high desirability and reliability there is a higher ‘confidence’ in that dataset and it is placed higher in the hierarchy than a dataset which for instance may have a high desirability but a low reliability.

5. Mapping the opportunities to enhance habitats for biodiversity

The first step in analysis to establish opportunities for natures recovery is to take the data evidence base established previously and a carry out a variety of habitat analyses to determine distinctiveness /character for use within other recognised methods (for example, biodiversity metric 2.0 etc). Furthermore, using the evidence base to apply methods to identify strategic habitat areas and habitat connectivity opportunity areas in relation to creating a robust nature recovery network for the district.

By utilising the knowledge of the counties habitats and species, experience of technical GIS systems and data management, coupled with the available datasets identified in the evidence base, it was possible to produce a number of outputs which are robust, challengeable and can deliver the districts nature recovery network.

5.1 Habitat distinctiveness mapping

Habitat distinctiveness mapping is one of several elements included within the biodiversity metric 2.0 (Crosher et al. 2019) by using habitat as a proxy for wider biodiversity value via associating and scoring different habitat types according to their relative biodiversity value. An example of this would be irreplaceable ancient woodlands scoring very highly (higher biodiversity value) whereas intensively managed amenity grassland or highly improved agricultural arable land score lower (lower relative biodiversity value).

The criteria used for the creation of the habitat distinctiveness map was based on the Biodiversity Metric 2.0 Beta test (Crosher et al., 2019) which loosely defines what habitats are included within each distinctiveness band. These metrics are currently emerging and form the basis of the Environment Bill (house of Commons 2019), but represent the most comprehensive set of standards for which to base the distinctiveness mapping on.
The distinctiveness map (map 1) was produced using Phase 1 habitat data by associating a distinctiveness value to each specific habitat type (e.g. arable land) in a GIS package based on guidance provided in Crosher et al. 2019, selecting and isolating the habitats spatially into the 5 respective distinctiveness bands. Further ratification to the irreplaceable habitats in the very high distinctiveness band was completed by use of priority habitat inventory (Ancient Woodland Inventory) boundaries. A spatial GIS file was produced for each distinctiveness band.

Further detail of the habitat distinctiveness mapping and the breakdown of habitats included within each distinctiveness band can be found in Appendix E.

Habitat distinctiveness mapping provides multiple uses outside of the biodiversity metric 2.0, including:

1. Identifying areas of high biodiversity value which are a priority for protection and expansion within a local plan whilst working in line with biodiversity mitigation hierarchy (avoid, minimise, remediate, compensate).

2. Flagging areas that may contain medium value (semi-natural) habitat. These could be highlighted in policy as requiring a comprehensive biodiversity evaluation if they are put forward for planning purposes (based on mitigation hierarchy). Biodiversity offsetting/compensation may be required in these areas if they are developed.

3. Identifying possible wildlife corridors which can be highlighted and designated as part of a local plan/Green Infrastructure Strategy. These areas could be the target of restoration projects/funding/aspirational opportunity areas funded through development compensation (obviously the allocation of funds is based on broad scale spatial analysis as opposed to the methods of calculating the offsetting requirement of a specific site).

Planning policy supports application of the mitigation hierarchy which determines a hierarchy of actions when using the biodiversity metric 2.0. This may mean retaining habitats in situ or avoiding habitat damage. It is easier to achieve biodiversity net gains where habitat impacts are avoided due to the way that habitat creation and enhancement risks are accounted for. The mitigation hierarchy is in the desirability order as follows:

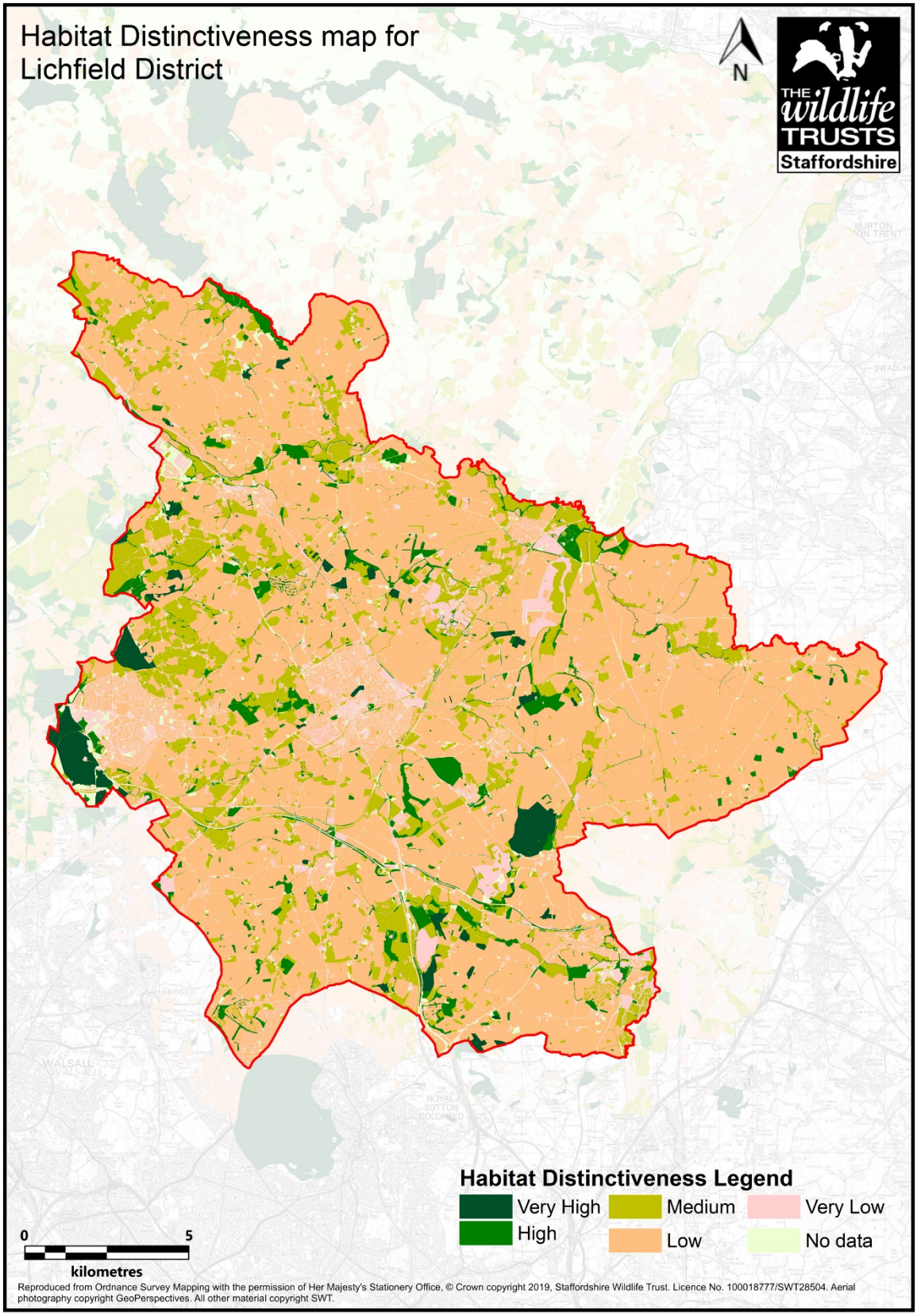
- **Avoid** – Where possible habitat damage should be avoided
- **Minimise** – Where possible habitat damage and loss should be minimised
- **Remediate** – Where possible any damaged or lost habitat should be restored
- **Compensate** – As a last resort, damaged or lost habitat should be compensated for

The mitigation hierarchy corresponds with the habitat distinctiveness mapping, e.g. very high distinctiveness habitats such as irreplaceable ancient woodlands should be avoided from development, low and medium distinctiveness habitats could be restored to a higher quality habitat.

The habitat distinctiveness mapping is based on available habitat data and the designated nature conservation site boundaries for the borough, including UK Biodiversity Action Plan (UKBAP) and priority habitat areas.

Habitat distinctiveness mapping does not include species explicitly. Instead, it uses broad habitat categories as a proxy for the biodiversity ‘value’ of the species communities that make up different habitats. The metric does not change existing levels of species protection and the processes linked to protection regimes are outside the scope of the metric.

Habitats are assigned to distinctiveness bands based on an assessment of their distinguishing features including for example rarity (at local, regional, national and international scales), and the degree to which a habitat supports species rarely found in other habitats.



Map 1 Habitat distinctiveness map for Lichfield District (2019)

5.2 Habitat distinctiveness mapping limitations

The distinctiveness mapping has been carried out using a desk based methodology utilising available habitat datasets at a landscape scale with a view of being able to quickly determine on a wider scale the likely impacts of a development, as such the landscape level distinctiveness map in some cases may not provide an accurate account of a sites full habitat distinctiveness at a finer scale (for example at site level). Due to this, developments requiring distinctiveness mapping as part of biodiversity offsetting net gain analysis should be subject to a thorough Preliminary Ecological Assessment (PEA) to determine the full extent of in situ habitats and the expected biodiversity impact of any potential habitat loss or damage.

5.3 Biodiversity metric 2.0*

The DEFRA Biodiversity metric 2.0 is designed to quantify biodiversity to inform and improve planning, design, land management and decision-making.

The metric can be used to both:

- Assess or audit **the biodiversity unit value** of an area of land and
- to **calculate the losses and gains** in biodiversity unit value from changes or actions which affect biodiversity, for example building houses or a change of use in a land holding.

The biodiversity metric 2.0 has 4 ‘quality components’ namely:

- **Distinctiveness** – based on the type of habitat present. For example, modified/amenity grassland is given a score of “2”.
    - Distinctiveness is determined by the habitat distinctiveness mapping (see section 5.2).
- **Condition** – based on the quality of the habitat. This is determined by condition criteria set out in the technical supplement.
    - This cannot be achieved as part of this exercise due to the difficulty of determining condition from a desk based methodology.
- **Strategic Significance** – based on whether the location of the development and or off-site work has been identified locally as significant for nature.
    - Strategic significance is determined by the individual habitat strategic areas and the combined strategic areas map (see section 5.3).
- **Connectivity** – based on the proximity of the habitat patch to similar or related habitats.
    - Connectivity is determined by combined strategic areas map & habitat connectivity opportunity maps (see sections 5.3 & 6).

* The DEFRA Biodiversity metric 2.0 is currently in a beta testing period, the final metric may be different to the metric used in this report.

Through the current study 3 of the 4 quality components have been assessed and defined at a district scale, the only exception being habitat condition which cannot realistically be assessed through a desk based methodology and would require further ground-truthing to determine actual unit values (for example through a Preliminary Ecological Appraisal (PEA)).

5.4 Strategic Habitat Areas

The Strategic habitat area methodology we have applied was developed and is currently being implemented by Warwickshire County Council (WCC) and was developed in partnership with Warwickshire Habitat Biodiversity Audit (WHBA), The University of York and Warwickshire Wildlife Trust. The methodology forms part of WWCs Sub Regional Green Infrastructure Strategy[*] and is used in targeting areas for habitat enhancement through biodiversity offsetting compensation.

This methodology was chosen for this mapping assessment because it can be relatively easily applied with the habitat data available; it is robust having been peer reviewed during development, it is already in use by an adjacent local authority and it is based on the fundamental principles of habitat connectivity identified in Lawton et al. (2010).

The mapping works by assessing the proportion of broad habitats e.g. woodland, grassland, heathland etc. within an area to determine whether these are ‘strategic’, ‘semi-strategic’ or ‘non-strategic’ for the creation or restoration of further habitat based on the proportion of habitat already present in the area.

The strategic habitat areas were produced using the composite Phase 1 habitat data identified in the evidence base review. Firstly specific higher quality habitats were selected and isolated from the composite Phase 1 habitat map (e.g. heathlands or species-rich grassland). The proportion of the selected habitats that overlap individual Ordnance Survey 1km grid squares was then calculated in a GIS package and each square subsequently classified into one of the area bands below, based on the area of habitat overlapping the 1km square. Specific details on the strategic areas are listed in appendix F.

The strategic habitat areas can be viewed as a hierarchy when it comes to the creation of a particular type of habitat:

1. **Strategic areas** are key areas to focus habitat creation or restoration. There is some high quality semi-natural habitat but additional high quality semi-natural habitat would improve the function of the network.

2. **Semi- strategic areas** are the next preferred areas in terms of habitat creation – These areas already have a relatively large area of high quality semi-natural habitat but more would still be of benefit.

3. **Non-strategic areas** are where there is very little or no high quality semi-natural habitat where it would be difficult to create enough high quality semi-natural habitat

[*] https://www.warwickshire.gov.uk/directory-record/2160/sub-regional-green-infrastructure-strategy

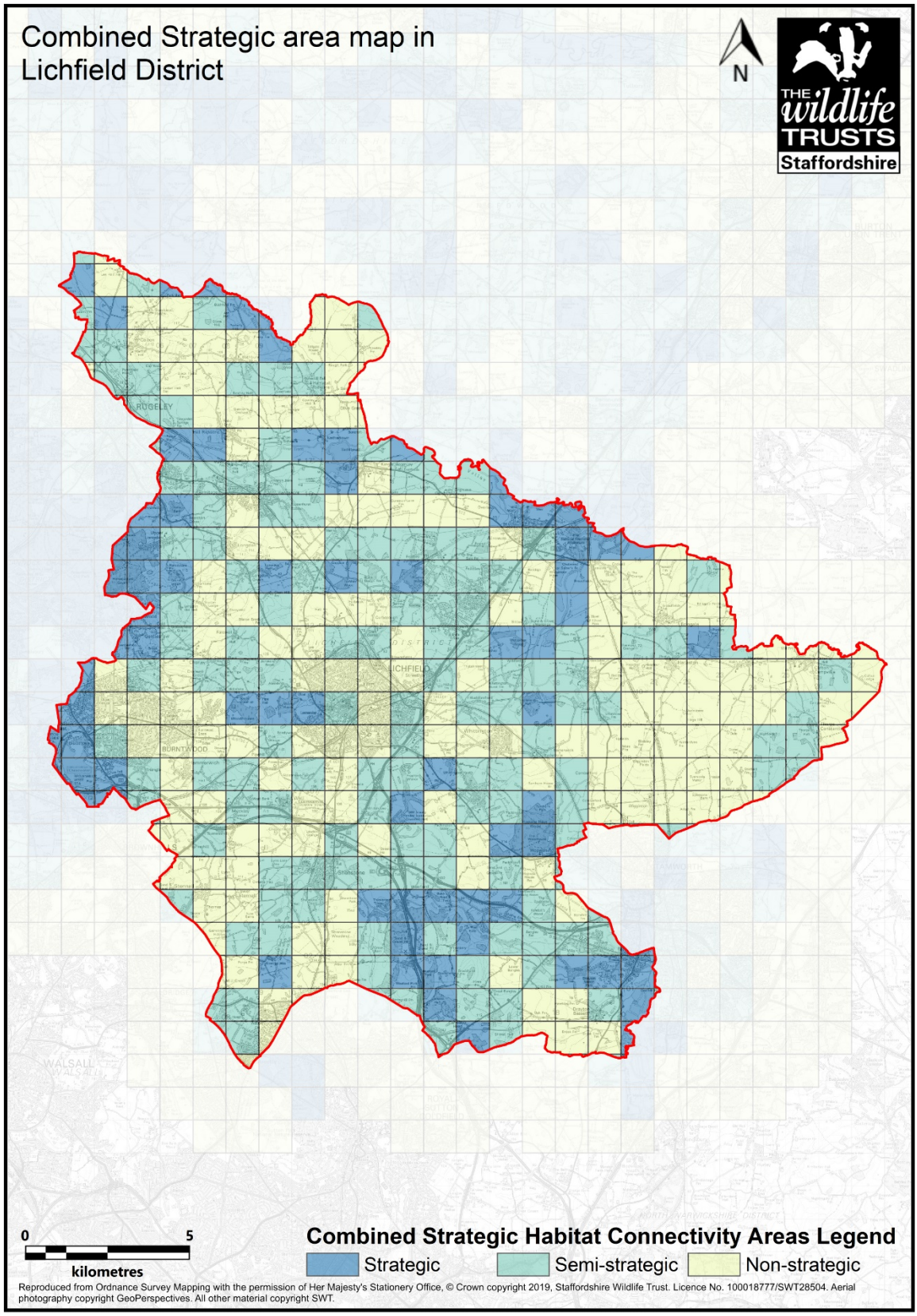
for it to be functional. (This is not to say that semi-natural habitats should not be created in this area but that it is lower in the overall hierarchy).

The strategic area mapping described will be crucial in delivering the fundamental principles in Lawton et al. (2010).

An overall strategic areas map was produced based on the combination of all the habitats analysed as part of the strategic mapping exercise (map 2). For this map, the criteria for strategic and semi-strategic areas have been swapped so that strategic areas are those with the highest amount of overall habitat. By altering the methodology in this way it is possible to create a coarse overall 'connectivity map' by highlighting the areas with highest combined overall habitat availability and connectivity as opposed to those areas where it is best to create habitats.

The strategic areas are not static and are merely a snapshot in time, changes are an inevitable part of the mapping as available habitat data changes. To an extent the strategic areas mapping is self-fulfilling, as opportunities to enhance habitats described by the map are practically implemented on the ground, mapped through subsequent monitoring and the new habitat data being incorporated into future maps will influence future changes in the areas on the map (described in more detail in section 10.2).

All strategic areas for each of the habitat types assessed are supplied as digital GIS appendices to this report.



Map 2 Combined strategic areas map for Lichfield District (2019)

6. Establishing the Habitat Connectivity Opportunity Areas (HCO) for Lichfield District

The strategic areas mapping described previously still leaves gaps between areas deemed to be strategic or semi-strategic for a particular habitat type, therefore the creation of habitats solely within these areas may still end up leaving isolated patches habitats which potentially do not link to one another within a landscape. In the interests of driving habitat creation in the direction of connecting these isolated spaces it is important to map an aspirational 'ideal' connected habitat network to work toward: A Nature Recovery Network.

Using local knowledge coupled with additional datasets including soils, nature conservation site boundaries, Staffordshire Biodiversity Action Plan (SBAP) Ecosystem Action Plan Areas (EAPs (appendix K) and priority habitat inventories along with a piece of ecological modelling software called Condatis (Wallis & Hodgson, 2012), it was possible to further scrutinise and refine the strategic areas map to define comprehensive Habitat Connectivity Opportunity (HCO) areas map for the district based on individual habitats.

The HCO areas add another dimension to the strategic areas modelling detailed previously to define where habitats are both already well connected and equally as crucially broadly identify where to direct the delivery of habitat creation or restoration to create a connected habitat network.

6.1 Habitat Connectivity Opportunity Areas Rationale

The decision to use Condatis to build upon the strategic mapping was in part due to the fact the software has previously been used to identify habitat connectivity in other areas of the county (Churnet Valley Landscape Ecology Pilot Partnership, 2014), where it worked well at identifying rough habitat corridors. Condatis also works on a per habitat basis it is therefore possible to analyse habitat connectivity on an individual habitat basis (A full technical explanation of the Condatis software can be found in appendix G). Condatis has some limitations in that it only takes into account a single habitat at a time and does not account for other potential connectivity barriers, for example urban areas. It is therefore crucial that these outputs were vetted against other relevant datasets such as soils data; ensuring that identified connectivity opportunities fall in line with the SBAP EAPs areas and that crucially the connectivity opportunity areas correspond with how local expert knowledge would expect the habitat connectivity areas to look in the district, to sense check what is produced by the models.

7. Results

7.1 Habitat Connectivity Opportunity Areas identified

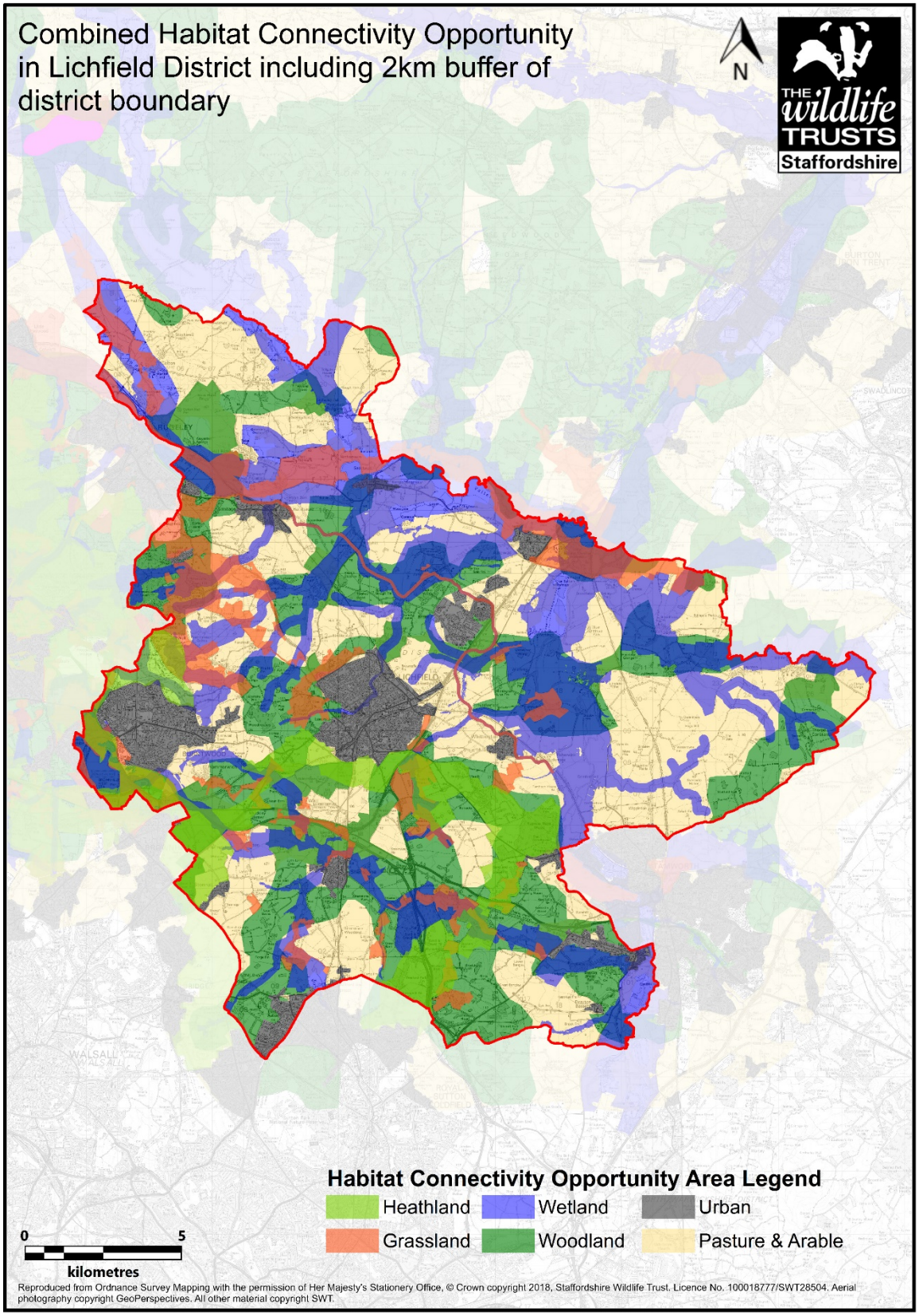
A total of 6 separate Habitat Connectivity Opportunity area types have been identified and mapped covering the entirety of Lichfield District:

1. Woodland
2. Grassland
3. Heathland
4. Wetland
5. Extensive pasture and arable Land
6. Urban Fabric

Each opportunity area is described in terms of its key habitat or habitats. This should not be taken to mean that other habitats are absent from the opportunity area, or that habitats identified as a priority in the opportunity areas should replace existing non-target high quality habitats of a different type.

The Habitat Connectivity Opportunity areas were brought together to produce a combined HCO map for the district (map 3).

Each opportunity area is described in more detail in the following sections, along with relevant associated land uses, environmental issues, and the overarching objectives and opportunities for each zone.



Map 3 Combined habitat connectivity opportunity areas map for Lichfield District (2019) NB: some of the HCO areas overlap one another which can lead to the colouring of the map being distorted.

7.2 Woodland Opportunity Area

Species rich hedgerows and woodlands are one of the highlights of the district habitat connectivity. Species rich hedgerows are an important feature of the district, particularly in its northern reaches acting as lifelines for species where otherwise there would be very little connectivity amongst large intensive pastures and arable fields.

On the whole woodlands in the district are small, fragmented and scattered amongst areas of intensively farmed land. There is no dominant type, with an assortment of broadleaved, mixed and coniferous woodlands, on the whole most woodlands are plantation with some more species rich semi-natural ancient broadleaved woodlands interspersed throughout the district. There are some larger woodlands in the district for example the large remnant ancient semi-natural and replanted woodlands at Hopwas Hays and both broadleaf and coniferous plantations around Weeford and on the edge of Cannock Chase.

There are few parkland sites are present within the district, with only a handful of smaller scattered sites which could be considered extensive parkland, notably Canwell Hall and Drayton Park in the south of the district. There are however a large number of parklands sites just outside of the district to the north which should not be disregarded in this exercise to be able to enhance connectivity between these sites and hedgerows/woodlands in the district.

There are a number of remnant veteran trees both in the parklands as well as in hedgerows and the wider countryside.

All ancient woodland sites in the district were included within the categorisation and assessment for this connectivity area, however some may exist outside of the woodland habitat connectivity opportunity area, for example if they are very small and isolated.

7.2.1 Key Habitats	7.2.2 Key species
• Woodlands • Hedgerows • Scrub • Urban green spaces • Veteran trees	• Cuckoo • Bluebell • Reptiles and Amphibians
7.2. 3 Threats	**7.2.4 Opportunities**
• Loss and fragmentation of irreplaceable woodland habitats (ancient woodland inventory sites). • Both residential and industrial development. • Inappropriate management of species-rich and/or ancient woodland sites either directly within or surrounding these sites leading to deterioration and lowering overall diversity. • Loss or deterioration of hedgerows and other associated habitats severing	• Protection of existing sites, particularly ancient woodland inventory sites and woodlands which are designated as Local Wildlife Sites. Planting of further future woodlands on sites which do not already support a priority habitat to improve connections of existing areas of high quality woodland and increase the area of woodlands which are ecologically functional for the species that they support. • Encourage relaxed management on the fringes of woodlands to provide a softer edge (e.g. scrub formation) habitat which is able to support both

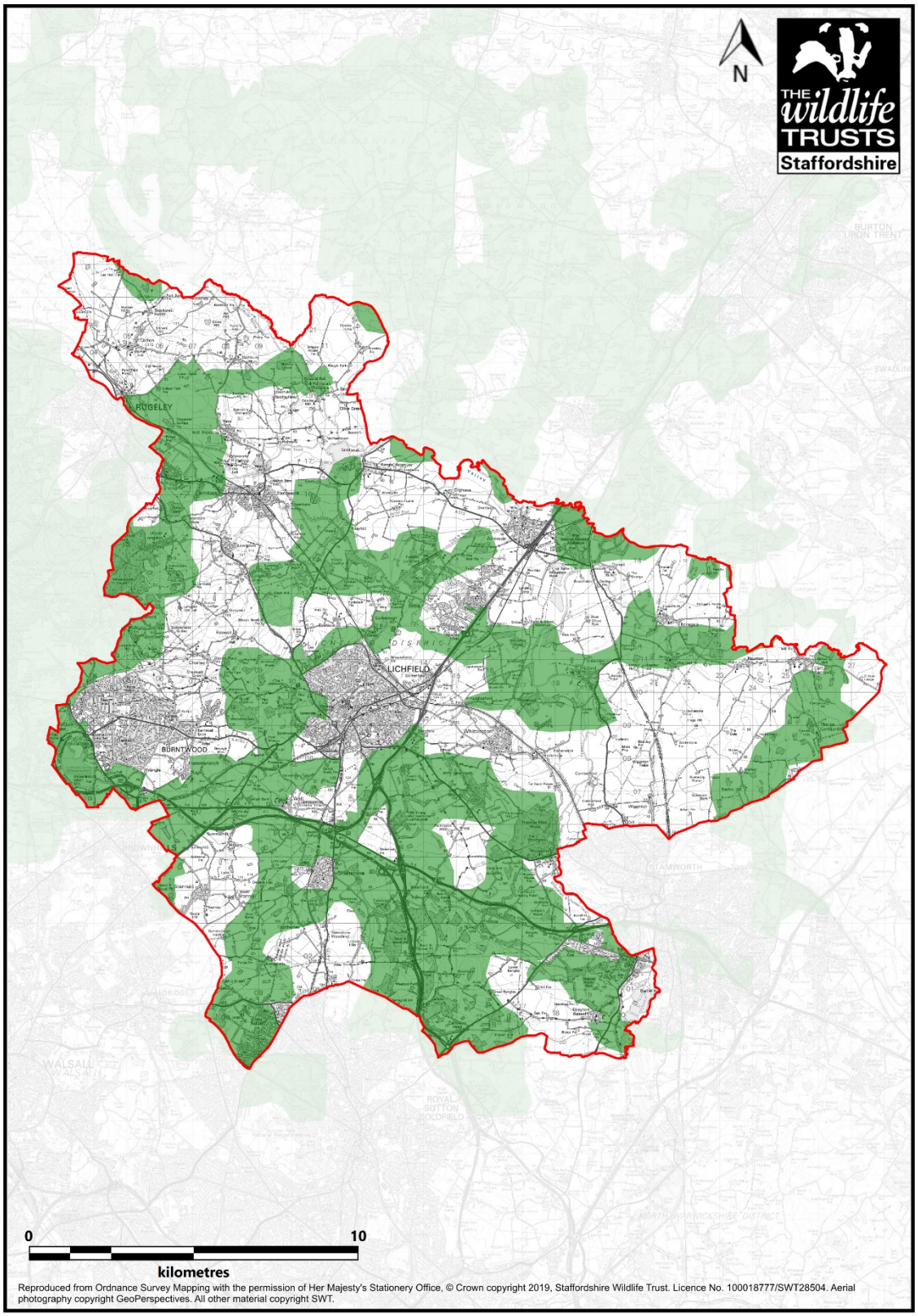
connectivity between woodlands and to other habitats. • Unsympathetic or poorly thought out woodland planting and creation on sites which already support another habitat, such as wildflower meadows, causing irreversible loss. • Replanting of ancient woodland sites with species which are not characteristic or native to the area.	more and a wider diversity of species, particularly birds and butterflies. ● Expand the area of existing woodlands. Create new areas of woodland that are in strategic locations and are of suitable size to act as stepping stones between existing woodlands. Woodland expansion and creation must not be detrimental to other high quality habitats for instance diverse grassland habitats. ● Use historical maps and data to determine the past extent of woodland areas, particularly where there may still be a rich ground flora in the seedbank for the restoration and expansion of ancient woodland sites. ● Planting new and maintaining existing hedgerows to better connect smaller isolated woodlands benefiting species migration and chances of breeding. ● Avoidance from or incorporating key woodlands into development sites, this is achievable through mitigation hierarchy in the biodiversity offsetting system. ● Restoration of Planted Ancient Woodland sites (PAWS) to native broadleaf or diversification of coniferous woodlands to include more native planting. ● Ensure that there is no loss or damage to known wood-pasture or parkland sites. ● Identification of, and promotion of the importance of veteran trees, both in woodland and in the wider landscape.
7.2.5 Specific opportunities	
• Ensure that species rich hedgerows in the north of the district are protected and suitably managed so that they are able to continue providing habitat connectivity into the future. • Encourage the creation and re-instatement of hedgerows, particularly in the large arable expanses to the north and east of the district for the benefit of habitat connectivity.	

- Protect and enhance semi-natural woodlands on the edge of Cannock Chase (where these provide connectivity between the district and the AONB/Special Area of Conservation (SAC).
- Ensure that Hopwas Hays Wood Ancient Woodland Inventory site is buffered and well connected to surrounding habitats of similar type (woodland and heathland), facilitating superior species movement between sites to improve their dispersal and survival chances.

7.2.6 Opportunities to enhance other benefits

- Flood risk mitigation
- Carbon storage
- Recreation and aesthetic
- Cultural heritage
- Wood fuel, timber and fibre
- Foraging / wild food

7.2.7 Map of Woodland Opportunity Area



7.3 Grassland Opportunity Area

This habitat connectivity opportunity area focuses on the areas of grassland which have a higher conservation value as opposed to area of generic grassland such as improved pasture and parks/gardens.

There are a number of grassland sites of a high biodiversity value scattered throughout the district, these include lowland meadow habitats, species rich pastures and wet grasslands. Although generally scattered, grasslands with a higher biodiversity value tend to be concentrated toward the north and west of the district particularly around Kings Bromley, Armitage, Handsacre, Longdon and Gentleshaw. Sections of road verge along the A51 between Lichfield and Rugeley also possess some species richness and provide good north/south connectivity from the more concentrated diverse grasslands in the north to those on the outskirts of Lichfield to the north and around Leomansley.

To the south of the district species rich grasslands are less frequent and more sporadic, connectivity still exists however the south-north connectivity is potentially degraded due to the presence of several major roads which run east-west around this area.

To the eastern side of the A513 in the district there is almost no diverse grassland at all, where they do occur they are on the districts northern border, land in this area consists mainly of intensively farmed pastures and arable land.

7.3.1 Key Habitats	7.3.2 Key Species
• Lowland meadows • Pastures • Hedgerows • Arable land • Open mosaic habitat on previously developed land	• Barn owl • Brown Hare • Grey Partridge • Skylark • Farmland birds • Bats (specifically Brown Long-eared, Noctule and Pipistrelle species) • Lapwing
7.3.3 Threats	**7.3.4 Opportunities**
• Development pressure • Poor management of key diverse sites including: ○ Over-grazing ○ Poaching ○ Neglect of Hedgerows ○ Over-cutting of Hedgerows • Nutrient intensification both from agricultural practices as well as diffuse pollution sources - nitrogen deposition. • Agricultural intensification • Management neglect of key diverse sites. • Global and local climate change.	• Ensure that all high quality grassland sites remain in positive conservation management, securing vital areas which can be used as sources of biodiversity into the future. • Protection of existing high quality grasslands and buffering these from potentially detrimental neighbouring land uses such as intensive farming practices. This could be achieved through encouraged uptake of agri-environment schemes, landowner liaison/education • Enhancement of any existing grassland sites or restoration of degraded sites so that they may achieve Local Wildlife Site Status and ensure that the management

• Habitat loss and fragmentation	of these sites persists to ensure that they remain diverse. • Reversion of arable land to diverse grassland where soils dictate. This is usually only carried out in certain circumstances due to the difficulty and cost associated however there are examples of this being successfully carried out in the borough. • It is critical that areas of high quality grassland are linked with mosaics of other high quality grassland to ensure that species reliant upon these habitats are able to move freely between them. • Use of Light Detection And Ranging (LiDAR) imagery to identify historical field patterns and features i.e. ridge and furrow to indicate where grassland restoration may be most successful as these areas have not or are unlikely to have undergone any serious agricultural improvement in the past.

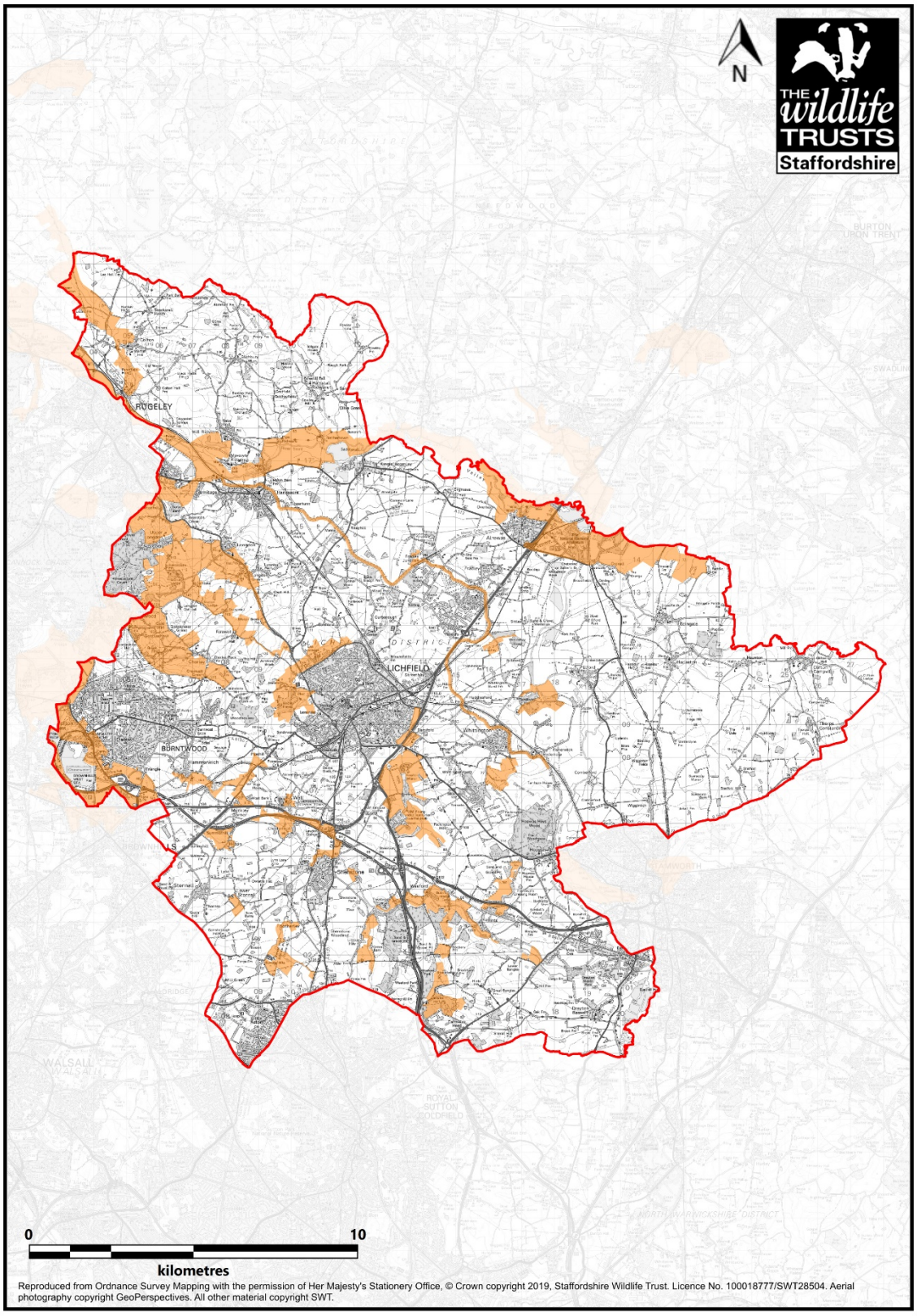
7.3.5 Specific Opportunities

- Ensure that road verge grasslands on the side of the A51 between Rugeley and Lichfield are safeguarded and appropriately managed to continue to act as an important north/south connectivity corridor between areas of diverse grassland.
- Ensure that high quality grasslands at Leomansley and north Lichfield are safeguarded.
- Protect, and improve connectivity of species rich grassland alongside the River Trent between Rugeley, Armitage, Handsacre and Hill Ridware to Kings Bromley.
- Protect core areas of species rich grasslands around Brereton, Longdon/Upper Longdon and Gentleshaw.
- Improve connectivity between scattered more diverse grasslands in the south of the district and those in Tamworth alongside the rivers Tame and Anker.

7.3.6 Opportunities to enhance other benefits

- Pollination
- Recreation and aesthetic
- Cultural heritage

7.3.7 Map of Grassland Opportunity Area



7.4 Heathland Opportunity Area

Lichfield district is a crucial area for this habitat type, and is one of the most important habitat types in the district in part due to the presence of regionally and nationally important areas of this habitat nearby i.e. Cannock Chase SAC/SSSI, heathlands at Sutton Park SSSI and further afield the lowland heaths in South Staffordshire around Highgate Common and Enville. Most importantly the district has the potential to provide habitat connectivity between the larger core areas of nationally and internationally designated lowland heath to strengthen habitat connectivity and reinforce the nature recovery network.

The western side of the district has the largest areas of managed in-tact high quality heathland with the fringes of Cannock Chase SSSI and Gentleshaw Common SSSI which is beginning to improve in quality evidenced by vegetation changes and presence of species not previously recorded on site.

Elsewhere, heathland patches are small and largely confined to the area south of Lichfield City, roughly following the line of the A5 from Muckley Corner through Pipe Hill, Whittington Heath to Hopwas, these sites are isolated generally fairly degraded. There are also some remnant heathland patches in the south of the district around Weeford.

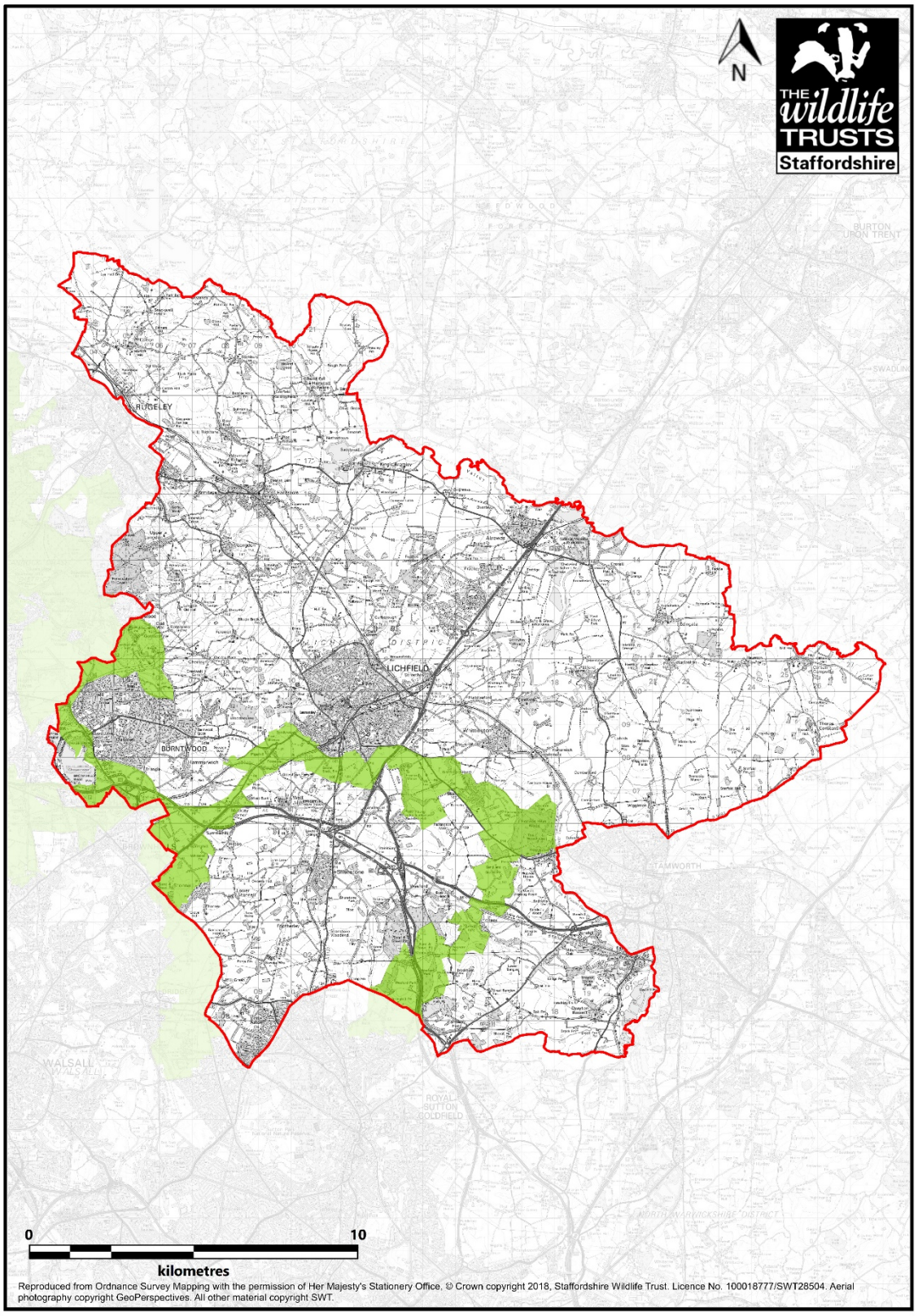
In the future these remnant patches could form the basis from which to improve the connectivity of this habitat in line with objectives set out in NCA 67.

Safeguarding and ensuring the existing heathland sites are effectively maintained as core stepping stone sites will be vital to establishing an effective connectivity corridor for this habitat and the specialist species it supports.

7.4.1 Key Habitats	7.4.2 Key Species
• Heathland • Woodland • Arable (buffer strips, set-aside etc.) • Grassland • Open mosaic habitat on previously developed land	• Heather • Nightjar • Fly agaric • Small Pearl-bordered Fritillary • Green Hairstreak Butterfly • Stag's-horn Clubmoss (*Lycopodium clavatum*) • Great Sundew (Drosera anglica) • Reptiles and Amphibians • Bog Bush-cricket
7.4.3 Threats	**7.4.4 Opportunities**
• Pollution both from acute and diffuse sources leading to nutrient intensification – e.g. Nitrogen loading. • Lack of management, improper management or neglect leading to scrub encroachment. • Potential hydrological impacts on areas of wet heath for example those at	• Protection of existing areas of high quality Lowland Heath through sympathetic management and ensuring that positive management continues and prevent degradation due to neglect. • Seek to create areas of new Heathland in key sites. This could be through development sites as part of

Pipehill Crossroads and Gentleshaw Common, for example extensive drainage on surrounding land which may lead to excess water leaving the site and a lowering of the water table. ● Tourism and recreational pressure. ● Mineral extraction. ● Agricultural intensification, both on and surrounding core areas of heathland. ● Urban development.	biodiversity offsetting mitigation, reverting plantation woodland stands into areas of heathland post harvesting similar to those carried out by the Connecting Cannock Chase project or through incorporating into existing habitat management such as arable field margins or relaxing the management regime in pastures etc. ● Regeneration of former sand and gravel sites by inoculation with heather seed and brash to kick start habitat formation and secure sympathetic management of these sites in future. ● Mitigate potential impacts of recreation pressure on sites such as Cannock Chase and Gentleshaw Common to ensure that the habitats and species which exist there can thrive, but can also be enjoyed by those who live in and visit the area. ● Ensure that sites listed on Natural England's Heathland Inventory are appropriately managed and monitored to retain key connectivity sites within the district.
7.4.5 Specific opportunities	
● Secure the creation of new heathland habitat on suitable sites in order to connect existing heathlands between Cannock Chase and Sutton Park SSSIs. Seek suitable sites to the south of Lichfield for habitat creation specifically to connect the isolated patches of existing remnant heathlands. This could take the form of either on-site or adjacent biodiversity net gain compensation for any developments on the periphery of Lichfield City. ● Ensure that existing isolated heathlands and heathland inventory sites for example those at Muckley Corner and Pipe Hill are well managed and buffered from edge effects of surrounding land management. ● Where suitable create new heathlands when restoring mineral extractions sites for example at Weeford, Stonnal and Hopwas.	
7.4.6 Opportunities to enhance other benefits	
● Pollination ● Cultural Heritage ● Carbon Storage ● Flood risk mitigation ● Recreation and Aesthetic	

7.4.7 Map of Heathland Opportunity Area



7.5 Wetland Opportunity Area

Watercourses and wetlands are a dominant feature in the landscape of the district, the rivers Tame, Trent and Mease flow through the district and their confluence lies on the districts norther edge. Chasewater and the Southern Staffordshire Coalfield Heaths SSSI, a large lake designated for its fens, mires and swamps and the species they support. Further to this there are a number of large waterbodies throughout the district as a result of past mineral extraction, some of which now support high quality habitats and act as important breeding sites for wading birds and roosting sites for overwintering wildfowl.. The flat terraced grasslands and arable fields adjacent to the many watercourses in the district are seasonally waterlogged and provide an existing important resource for wintering waders and wildfowl and also present opportunities for habitat restoration by re-instating more traditional management for water control structures to recreate older traditional flood meadows.

A number of smaller ponds are also scattered throughout the borough which will be of great importance to a range of other animals such as bats and amphibian species. Due to the mainly intensive agricultural nature of the district It is highly likely that many of these small ponds will be isolated, ephemeral and potentially subject to high levels of eutrophication or degradation due to surrounding intensive land uses so identifying and conserving those which are of high diversity and conservation value will be of importance to secure their connectivity to wider wetland sites.

7.5.1 Key Habitats	7.5.2 Key Species
• Woodland • Grassland • Pasture • Arable • Urban fabric/mosaic habitats	• Otter • Great Crested Newt • Freshwater White-clawed Crayfish • Numerous waders and wildfowl • Harvest Mouse • Reptiles and Amphibians • Lapwing • Bittern
7.5.3 Threats	**7.5.4 Opportunities**
• Mineral extraction. • Pollution from acute and diffuse sources. • Poor land management, livestock in and near watercourses and waterbodies, soil erosion leading to eutrophication of water bodies and loss of habitat in watercourses. • Historic deepening and straightening of watercourses, meaning that rivers and streams lack natural features such as gravel beds. Water is disconnected from floodplains.	• Protection of existing high quality wetland sites particularly those with a nature conservation designation. This will be achieved through the identification of environmental issues for example pollution from agricultural run-off and subsequent remediation for instance through Rural SuDS. These sites should be buffered from any potential sources of damage both through creation of habitat around key sites to provide a ‘soft edge’ habitat and landowner liaison to address issues. • Identification of the most suitable locations for the targeting and prioritisation of further wetland creation

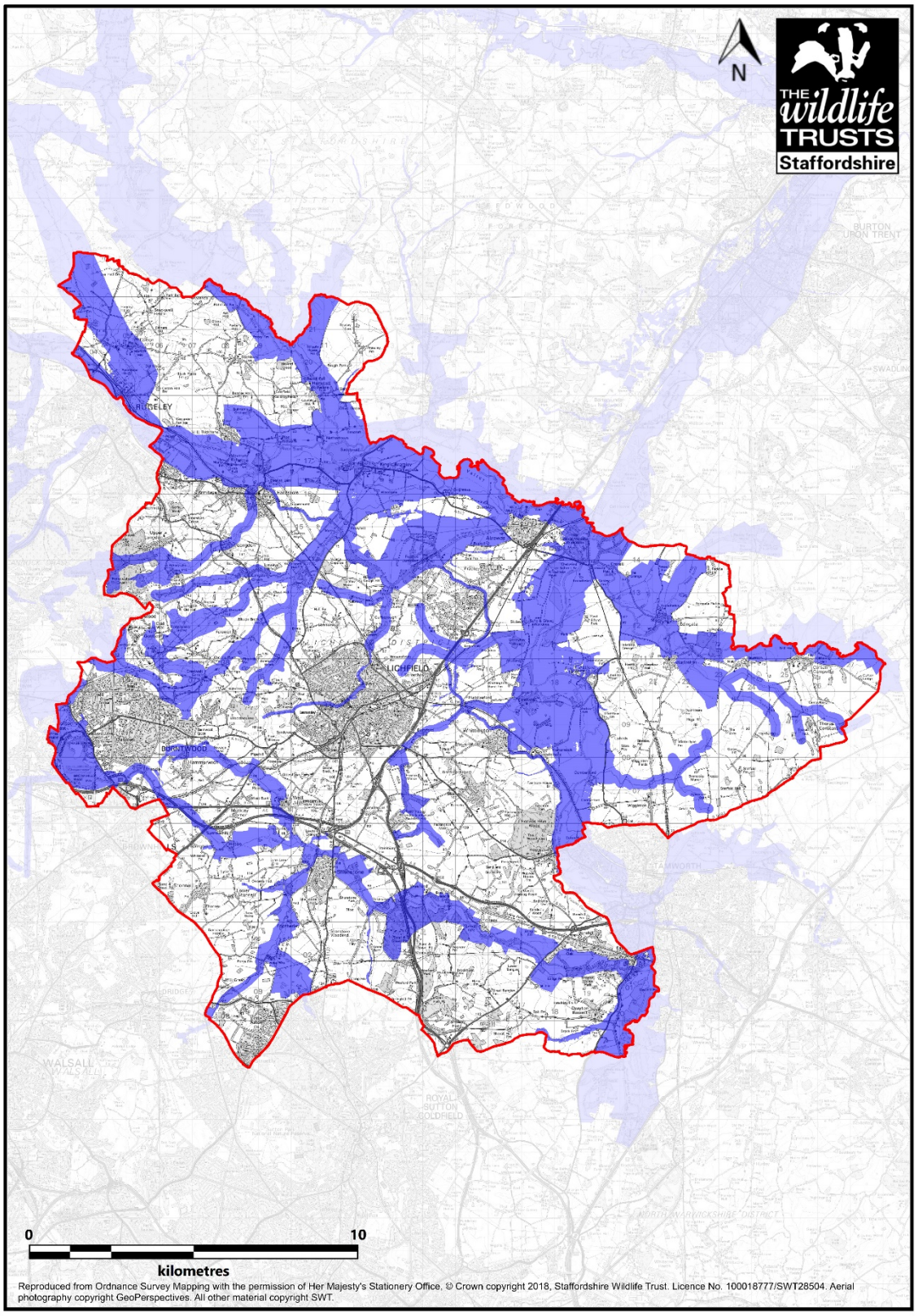
● In some areas removal of tree cover and grazing leading to habitat degradation. ● Lack of understanding of the need to protect water throughout the catchment including areas where there are no obvious watercourses. ● Global and local climate change. ● Loss of 'coarse' habitat to development or agricultural intensification which would otherwise impede the flow of water leading to: ○ Increased flood risk. ● Invasive Non Native Species (Himalayan Balsam (*Impatiens glandulifera*), Parrot's-feather (*Myriophyllum aquaticum*), *Azolla* sp, *Crassula helmsii* etc.). ● Disease/Biosecurity.	and enhancements. These should be connected to other ● Seek opportunities to deliver Natural Flood Management delivery to address flood risk as well as provide additional areas for habitat provision. ● Look for opportunities to carry out river reprofiling/naturalisation, improve flood storage and provide additional habitats suitable for a range of species particularly breeding waders and wintering wildfowl. ● Use historical maps and LiDAR information to identify historical wetland and river features, sluices, water meadows etc. which could potentially be restored to deliver both flood risk mitigation and habitat improvements. ● Use flood models to dictate where work can be targeted to both deliver improved flood mitigation as well as deliver further habitat works ● Ensure that sand and gravel quarry extraction sites are effectively restored and provide additional benefits for wildlife. There is a huge opportunity here to deliver biodiversity and flood mitigation objectives. ● Effective mitigation for the loss Great Crested Newt habitat as a result of development. (Priority areas for the creation of compensatory pond clusters would need to be addressed at a finer scale using Great Crested Newt (GCN) metapopulation data and modelling).
7.5.5 Specific opportunities	
● Additional river re-profiling work at Staffordshire Wildlife Trust's Croxall Lakes nature reserve to further increase biodiversity value and flood resilience. The site can act as both a valuable source of biodiversity in future throughout the Trent Valley and will showcase what is possible to achieve on such a large watercourse to benefit both biodiversity and flood resilience in future. ● Support habitat conservation and enhancement projects defined through the TTTV project along the Trent and Tame, engage with landowners in these areas to discuss potential project ideas and find methods of funding and delivering those proposals.	

- Ensure that habitats on the Trent and Mersey and Coventry Canals are safeguarded and appropriately managed to keep a key connectivity link throughout the heart of the district.
- Work with Natural Processes (WWNP) for example through natural flood management or introduction of coarse woody debris along the Shropshire Brook, Ben Brook, Bilston Brook and Ashmore Brook to conserve and enhance wetland habitats and therefore maintaining and improving connectivity between the Cannock Chase AONB and the wetland areas of the Trent and Tame valleys.
- WWNP along the Black/Bourne Brook, discuss new Environmental Land Management Schemes/WWNP with surrounding landowners to protect and enhance habitats within the catchment of this watercourse.
- Ensure that the River Mease SAC is adequately buffered from diffuse and point source pollution, engage with landowners to discuss land management for riparian habitats and ways to derive mutual benefits from WWNP (creation of swales, ditches, attenuation ponds etc.) for both farmers and wildlife.
- Protect and buffer/expand the high quality linear habitats on the Trent & Mersey/Coventry/Birmingham & Fazeley Canals which provide an important movement and feeding corridor for a number of animals such as Kingfisher and Bat species.

7.5.6 Opportunities to enhance other benefits

- Flood risk mitigation
- Water quality
- Recreation and aesthetic
- Cultural eritage

7.5.7 Map of Wetland Opportunity Area



7.6 Pasture and Arable Opportunity Area

The majority of the borough is covered by some form of intensive agriculture, either for arable production or improved pastures.

East of the A513 in the district the majority of the land is occupied by intensively farmed pasture and arable land with small scattered woodlands but lacks any other significant areas of semi-natural habitat.

Compared to the other habitat connectivity opportunity areas there are few locally or nationally designated nature conservation sites within this habitat connectivity opportunity area. Semi-natural habitats in this area are few, aside from scattered woodlands and occasional older diverse hedgerows

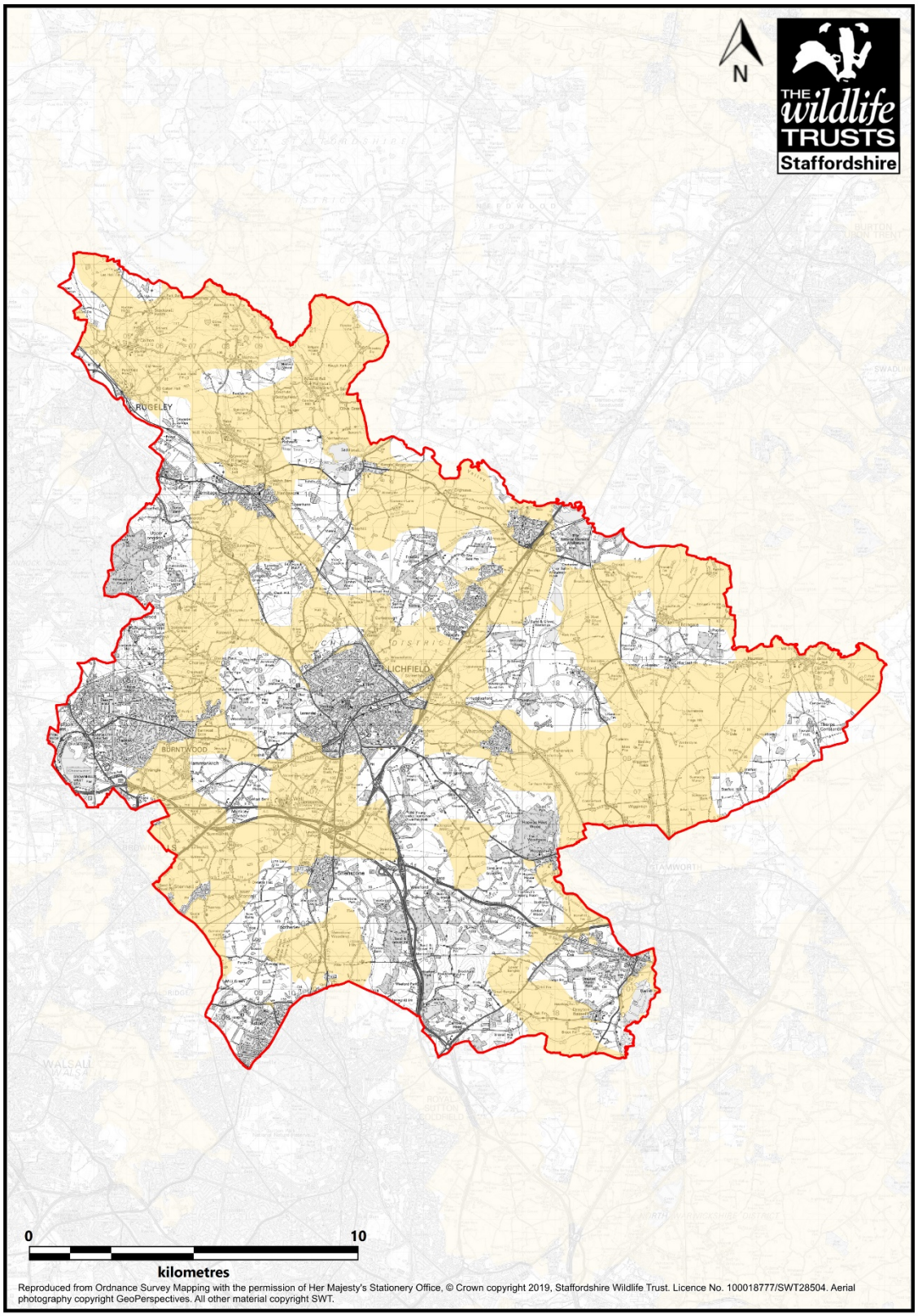
Objectives for this area could be considered lower on a hierarchy in terms of their potential opportunities as the relative benefits that can be derived from improvements to very intensively managed agricultural land are likely to be small or require a lot of time and resource to restore higher quality habitats. Therefore where applicable, opportunities within habitat connectivity opportunity areas focused toward semi-natural habitats should always be considered first where there are overlaps between the two.

7.6.1 Key Habitats	7.6.2 Key Species
• Grassland • Woodland • Hedgerows • Mature and veteran trees	• Barn Owl • Brown Hare • Harvest Mouse • Polecat • Grey Partridge • Wall Brown butterfly
7.6.3 Threats	**7.6.4 Opportunities**

• Habitat fragmentation.
• Agricultural intensification.
• Urban encroachment.
• Pollution of waterways.
• Loss and deterioration of ponds for example through changes in water management or nutrient intensification.
• Improper management e.g.
  ○ Over-grazing
  ○ Poaching
  ○ Neglect of hedgerows
  ○ Over-cutting of hedgerows
	• There are a wide range of opportunities for more intensively farmed agricultural land ranging from very small interventions such as leaving one corner of an arable field as set aside to provide feeding opportunity for farmland seed eating birds to large whole farm scale interventions for example reversion of large areas of arable land into diverse grassland. Obviously the scale of the intervention is down to what is practical and ultimately what is desirable, cost effective and sustainable in the eyes of landowners and land managers.
	• Link up existing semi-natural habitats through the creation of habitat corridors and networks using hedgerows, arable field margins and watercourses where possible.

	• Reversion of arable to other habitats with a higher biodiversity value for example species rich grassland. • Encourage uptake or movement toward organic production methods or holistic grazing management over reliance on supplementary feeding or indoor systems for example. • Where developments are likely to impact on large areas of intensive farmland, ensure that as a result some of the developed area is dedicated to the provision of high quality semi-natural habitats which may greatly improve habitat availability and connectivity within the landscape.
7.6.5 Specific opportunities	
• Encourage uptake of environmental land management schemes in the east of the district to increase habitat availability and landscape permeability for a range of species associated with farmlands e.g Barn Owl, Grey Partridge, seed eating birds, Harvest Mouse, butterflies and other invertebrates. This should help provide both north-south connectivity and east-west connectivity and help link various landscape partnership schemes.	
7.6.6 Opportunities to enhance other benefits	
• Water quality • Cultural heritage • Food production	

7.6.7 Map of Pasture and Arable Opportunity Area



7.7 Urban Fabric Opportunity Area

The district is largely rural, existing in the space between the Birmingham and Black Country area and the town of Sutton Coldfield to the south, East Staffordshire and the town of Burton to the north, Tamworth to the south-east and Cannock to the West.

Two large urban cores exist in the district, Lichfield City and Burntwood which lies on the periphery of the larger conurbations of Brownhills and Heath Hayes/Cannock.

Elsewhere the district has smaller scattered villages such as Armitage with Handsacre, Alrewas, Kings Bromley and Shenstone. Most significant urban areas are located in the western or central parts of the district whereas the east is predominantly rural with small hamlets and farmsteads.

A large industrial/business park is located at Fradley in the centre of the district alongside the A38 which has been classed as an urban area as the habitat and the type of opportunities this area presents are similar to those from within a typical urban housing environment.

7.7.1 Key Habitats	7.7.2 Key Species
• Grassland • Woodland • Open Mosaic Habitat on Previously Developed Land (brownfield habitats) • Wetland • Rivers and streams • Street trees (particularly those in environments where other green space is lacking)	• Hedgehog • Great Crested Newt • Slow Worm • Invertebrates and pollinators • House Sparrow • Toads and other amphibians • Finch species.
7.7.3 Threats	**7.7.4 Opportunities**
• Habitat fragmentation through the loss of both sources of biodiversity as well as habitat ‘stepping stones’ and linear pathways which species require to be able to disperse. • Pollution both from acute and diffuse sources leading to the loss of diversity in waterways etc. • Urban expansion • Redevelopment of Open Mosaic Habitats on Previously Developed Land (OMPDL) which are often important sites for a number of species in urban areas. • Intensive management of urban green spaces leading to: • Invasive species	• The key objectives in these areas is not to connect urban areas together but to enable permeability between rural and urban landscapes, especially where high quality semi-natural habitats exist in close proximity to or within these areas. In doing this it is possible to benefit habitat connectivity but also bring wildlife closer to people. • Ecological enhancement of existing urban green spaces, for example through improving the diversity of amenity grassland in parks by seed sowing and green hay strewing, enhancement or creation of wetlands in SuDS • Creation of new habitats when planning new urban developments, make new developments as green as possible to bring high quality habitats

• Increased flood risk due to increased area of hard impermeable surfaces.	and improve habitat connections in the urban environment. This may include for example green roofs/green walls, wildlife friendly SuDS which can be planted with native wetland species, rain gardens to slow the flow of water. • Ensure that urban green spaces are managed appropriately to provide the best benefits for wildlife and people - this may include relaxing mowing regimes to create and maintain more diverse grasslands, thinning of plantation woodlands to improve structural diversity or invasive species control. • Ensure that linear features such as canals, old railway lines, road verges, hedgerows are managed for the good of wildlife as these are often critical pathways for biodiversity in and out of the urban environment. • Provide suitable opportunities in existing and new developments for protected and Biodiversity Action Plan (BAP) species for example bats, hedgehogs and pollinators.

7.7.5 Specific opportunities

Lichfield

- Ensure that grassland sites on the periphery of Lichfield such as those at Leomansley and north Lichfield are protected and improve the biodiversity value of existing urban green space nearby (which does not impact upon any other existing infrastructure) to enable better connectivity of these sites into the urban landscape.
- Ensure that the Leomansley brook is protected and where possible contribute biodiversity enhancements particularly working with natural processes (WWNP).
- Future developments at Fradley should benefit habitat connectivity by retaining high quality existing habitats on site and creating complimentary habitats either on-site or nearby as part of biodiversity net gain proposals.

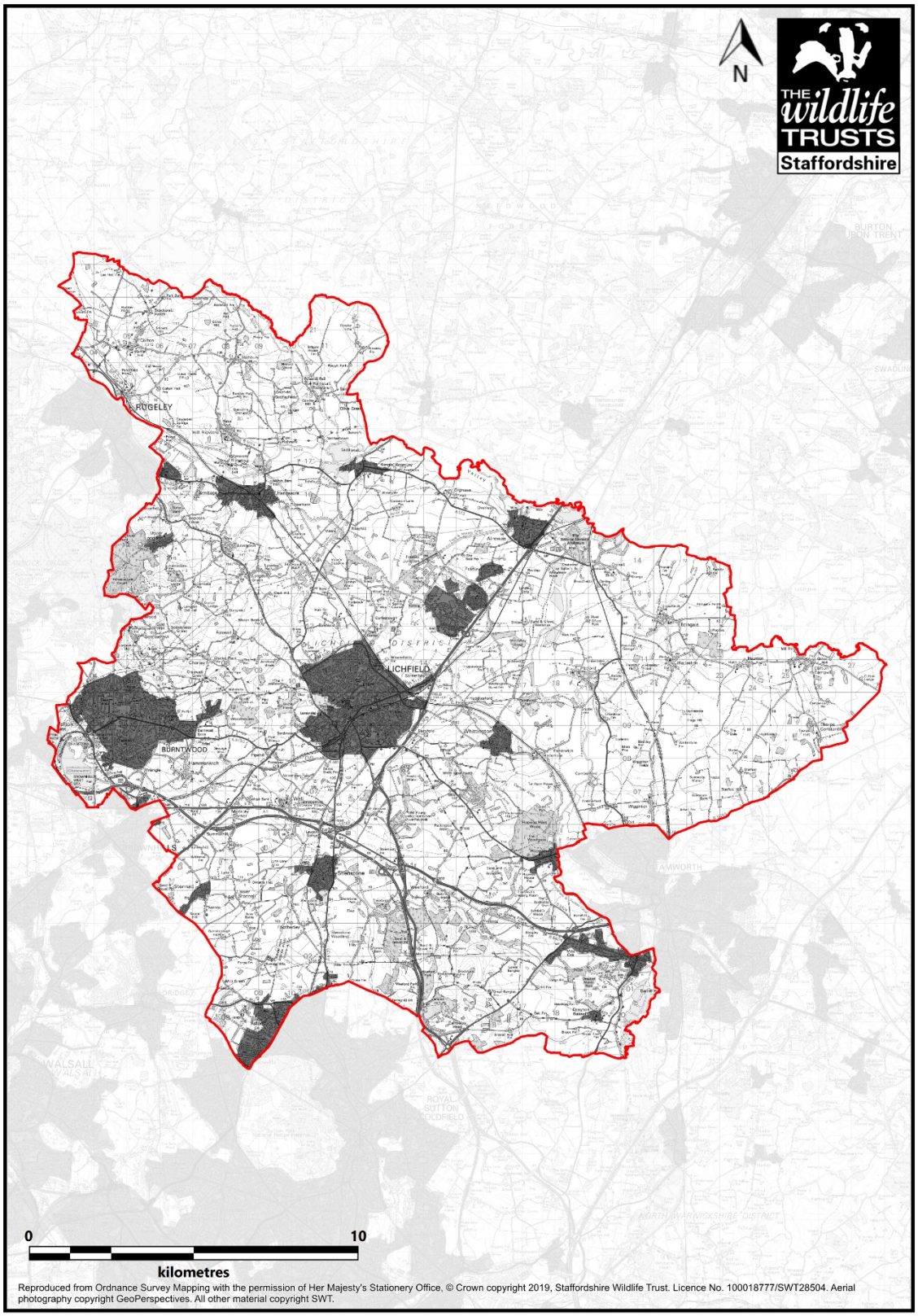
Burntwood

- Protect and buffer the diverse habitats on the periphery of Burntwood, particularly to the North and West around the SSSIs of Gentleshaw and Chasewater.
- Any future developments to the east of Burntwood and west of Lichfield should contribute to habitat connectivity through biodiversity net gain through either on-site or nearby with a particular focus on the creation of lowland heath and species rich grasslands to strengthen the existing networks.
- Where possible seek to enhance the habitat biodiversity value in the network of small available urban green spaces to improve ‘stepping stone’ habitat connectivity. This could be in the form of a community project supported through biodiversity net gain.

7.7.6 Opportunities to enhance other benefits

- Recreation and aesthetic - improved access to and increased number of natural resources.
- Health and wellbeing - improved access to an increased number of natural resources.
- Flood risk mitigation - More green areas lead to increased habitat coarseness which slows the flow of water, Sustainable Drainage Systems (SuDS) schemes increase habitat and hold water away from vulnerable areas.
- ‘Pocket Parks’ encouraging local people to take up management of small urban green spaces to benefit both wildlife and those which live nearby. By adopting multiple pocket parks it is possible to create a stepping stone network throughout the urban environment.
- Urban cooling – suitable tree planting, increased green space and green developments, green walls, green roofs etc.
- Cultural heritage - access to nature and traditional landscapes.
- Public engagement - opportunity to educate people on ecology and the natural world and what people can do to provide space for wildlife in gardens, allotments, local parks etc.

7.7.7 Map of Urban Fabric Opportunity Area

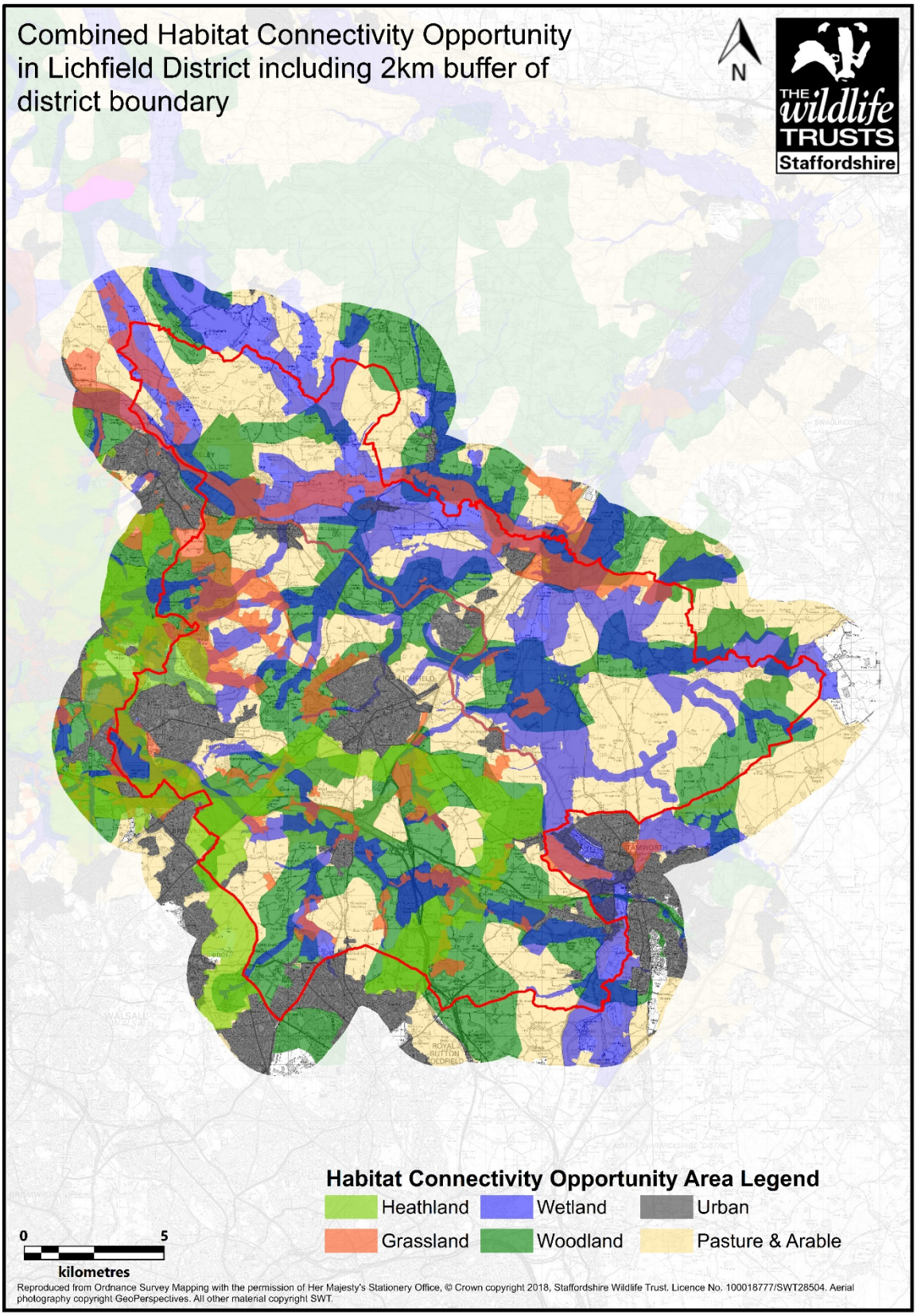


8. Cross boundary habitat connectivity

As habitats and wildlife do not adhere to political boundaries it is important to take into account habitats which exist on the other side of political boundaries to ensure that there is no ‘hard edge’ where for example a Habitat Connectivity Opportunity area ceases to exist at the edge of a county or district boundary despite there being suitable habitat

Map 4 illustrates this, showing the Habitat Connectivity Opportunity areas combined map including a 2km radius buffer around the district boundary. Despite the buffered radius falling outside of the district and county boundaries habitat connectivity into these areas has been considered as part of the mapping to ensure this ‘hard edge’ has been avoided. It must be noted however that the HCO areas do not extend large distances into neighbouring authority areas with the ultimate goal that all authority areas will have a mapped Nature Recovery Network which dovetails with this NRN mapping.

The cross boundary HCO areas in neighbouring local authorities may be subject to change based on any future NRN mapping which may be commissioned by the respective local authority in its jurisdiction. At this stage Habitat Connectivity Opportunity areas identified outside of the district should only be considered potential and may be subject to future changes. These areas have been included in this assessment to demonstrate the duty to cooperate across boundaries has been considered in this mapping exercise.



Map 4 Combined habitat connectivity opportunity areas map for Lichfield District including a 2 kilometre buffered radius of the district boundary (2019). NB: some of the HCO areas overlap one another which can lead to the colouring of the map being distorted.

9. Practical Application of the maps

The HCO maps detailed are designed to be used in conjunction with the biodiversity metric 2.0, however the habitat connectivity opportunity areas and the bottleneck analysis can be used to both inform the metrics and target the location and application of future ecological enhancements contributing to a functional nature recovery network.

The HCO areas are based around the principle of habitats being ecologically functional and well connected to one another within the landscape. This means that habitats are able to both support a high population and diversity of species, meaning these species have the ability to be able to move freely within the landscape, as a result of good habitat connectivity.

These areas promote the conservation, restoration and enhancement of certain priority habitats, ecological networks and contribute to the protection and recovery of associated priority species within defined geographic areas.

Crucially the habitat connectivity opportunity areas mapping has no white space as there are always opportunities for the delivery of habitat creation or enhancement anywhere in the landscape irrespective of whether it has been identified as a connectivity area for a priority habitat or not. Taking this approach ensures that the landscape as a whole can remain permeable for our flora and fauna and resistant to both local and global impacts. See appendix H for full technical details on the principles of HCOs and mechanisms for delivery.

The habitat connectivity opportunity areas identify the key areas where the creation of new habitat is best prioritised to benefit habitat connectivity within the landscape. Targeting additional habitat creation in this way will have the greatest impact on both availability and connectivity of habitat within the landscape as it builds upon areas which already possess some good quality habitats but by increasing their size, quality, coverage and connectivity within the landscape will enable those habitats to become more functional.

Within these areas there are further opportunities to deliver environmental outcomes within existing spatially defined partnership schemes, specifically:

- Transforming the Trent Valley (TTTV)
- Central Rivers Initiative (CRI)
- Cannock Chase Area of Outstanding Natural Beauty (AONB)
- Cannock Chase Special Area of Conservation (SAC) partnership
- River Mease Special Area of Conservation (SAC) partnership
- National Forest
- Forest of Mercia
- Staffordshire Local Wildlife Site (LWS) Partnership

The way that the opportunity areas are generated means that habitat opportunities are not mutually exclusive of one another i.e. there can be overlapping areas for multiple habitat types; for instance an area defined as an opportunity for woodland enhancement may also provide a good opportunity for improving grassland and wetland habitat enhancement and

connectivity. The on-site prioritisation of what habitat to create where must therefore rely upon both the opportunity areas as well as local ecological expert knowledge so as not to risk either damaging connectivity or destroying existing good quality habitats.

10. Next Steps

10.1 Habitat connectivity bottlenecks

Bottlenecks highlight the areas of habitat which have the highest ‘strain’ in terms of supporting connectivity within the nature recovery network. These areas are where there is a high flow of species through an area with relatively few links and over a long distance (i.e. a very concentrated flow of species movement squeezing through a very small area of habitat and being forced to jump large distances between patches of suitable habitat). Producing detailed guidance in how this can best be addressed will enable informed focused positive impacts that directly reduce strain on the habitat connectivity network.

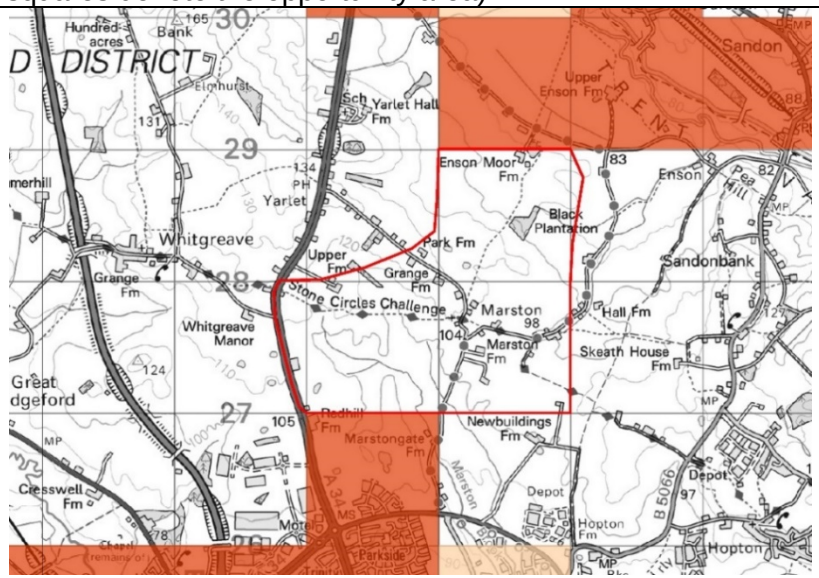
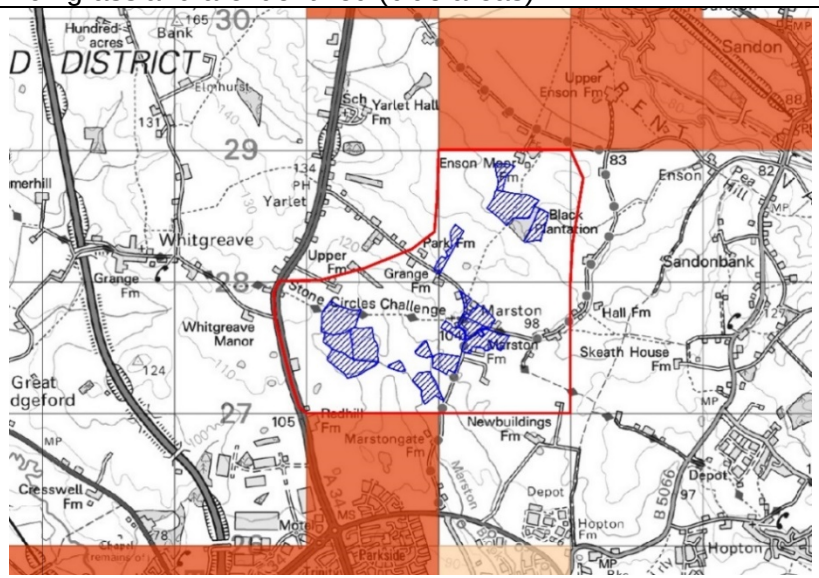
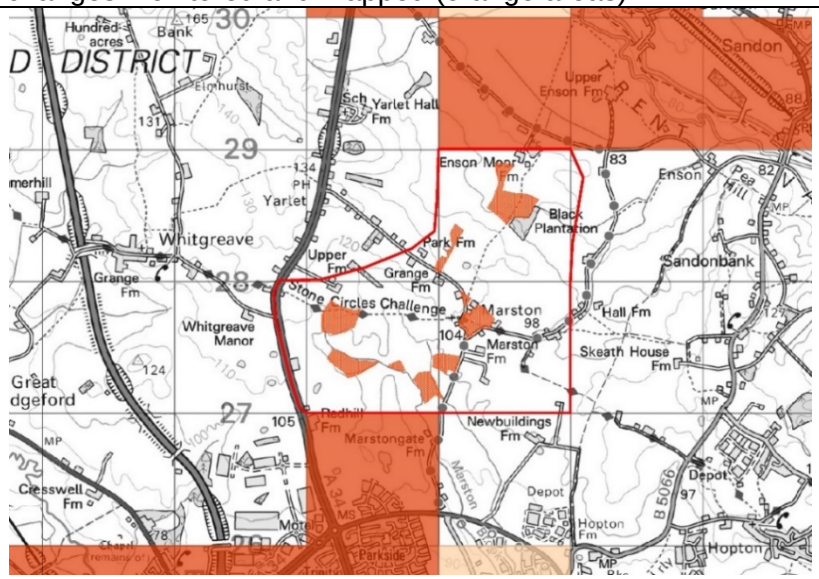
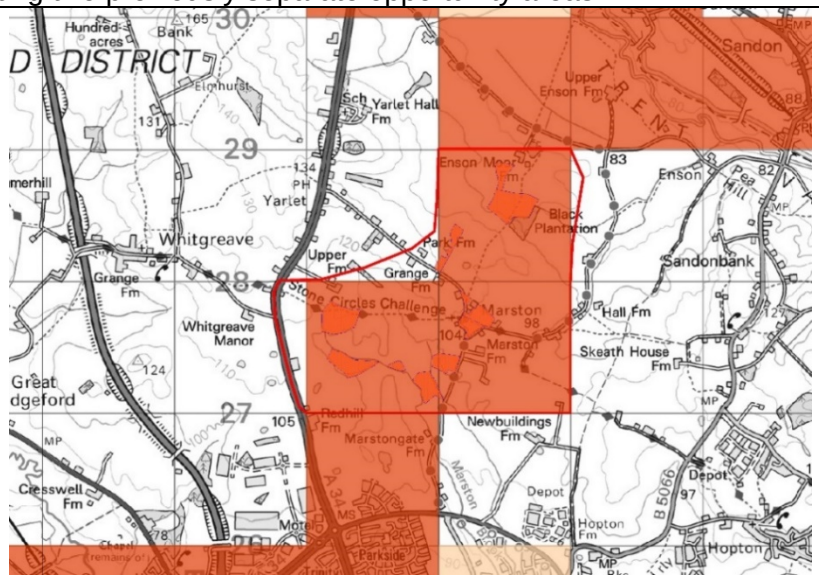
Bottlenecks can be used to determine the optimal locations to create and restore habitats to benefit connectivity and reduce ‘strain’ on the habitat network. Creating, enhancing and restoring habitat in these locations will not only benefit by reducing strain on the network but also reduces the risk or likelihood of losing what may be an important link in a habitat connectivity network which is already under pressure.

10.2 How the strategic mapping will evolve over time

As discussed previously, the opportunity map is not static and as physical habitats change on the ground and are subsequently mapped and monitored the map itself will evolve with these updates. It must be stressed that the opportunity areas themselves are where work to enhance habitats is focussed as this is where the opportunity to get the greatest benefits lies, the following example purely illustrates how the process of habitat improvement over time can influence changes in the map itself.

11. In Conclusion

The results of the updated Nature Recovery Network do closely reflect what was originally shown in the biodiversity opportunity assessment within the Biodiversity & Development SPD 2016. However, the analysis and opportunity areas mapped within the new nature recovery network are much more fine scale and are based around a more robust defensible methodology that can more clearly deliver against NPPF and PPG objectives, as well as those likely to emerge as outlined in the Environment Bill (House of Commons, 2019).

1: A small gap is identified between opportunity areas for grassland (Orange shaded squares denote the opportunity area).	**2:** Broad scale aspirations for the creation, restoration or enhancement of species-rich grassland are identified (blue areas).
	
3: In time some of the aspirations are realised, leading to enhanced grassland habitat, changes monitored and mapped (orange areas).	**4:** The newly mapped habitat data has now influenced the opportunity area connecting two previously separate opportunity areas.
	

12. Glossary

Term	Definition
Biodiversity Action Plan/ UK Biodiversity Action Plan	A biodiversity action plan (BAP) is an internationally recognized program addressing threatened species and habitats and is designed to protect and restore biological systems. The original impetus for these plans derives from the 1992 Convention on Biological Diversity (CBD). The UK Biodiversity Action Plan (UK BAP) was published in 1994, and was the UK Government's response to the Convention on Biological Diversity (CBD).
Geographic Information System (GIS)	A computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. By relating seemingly unrelated data, GIS can help individuals and organizations better understand spatial patterns and relationships.
Light Detection And Ranging (LiDAR) imagery	Remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth to create a digital topography elevation map.
Local Wildlife Site (LWS)	Local Wildlife Sites are areas with locally significant nature conservation value. They come in all shapes and sizes, from small wildflower meadows and secluded ponds to ancient woodlands. Most are owned by private individuals.
Natural capital	Natural capital can be defined as the world's stocks of natural assets which include geology, soil, air, water and all living things.
Nature conservation site	This is a blanket term is used to describe all sites which have a land use designation relevant to nature conservation or are managed in the interests of nature conservation and wildlife for example, Local Wildlife Sites, SSSI or Nature reserves.
Non-statutory nature conservation site	Non-statutory sites (specifically LWS) receive some protection from development via local planning documents which recognise the need to protect and enhance designated sites and those of interest without a statutory designation.
Site of Special Scientific Interest (SSSI)	Sites of Special Scientific Interest are areas of very high nature conservation value which are legally protected nationally, these sites are normally the best remaining examples of natural habitats and may also have an international designation e.g. Special Area of Conservation (SAC).
Statutory nature conservation site	A site with a designation which is upheld and protected by law e.g. SSSI or SAC
Sustainable Drainage Systems (SuDS)	Sustainable drainage systems (SuDS) are a technical solution to addressing issues that arise with the increasing problem of excess surface water. Originally used in urban areas, they are now used for some roads and towns in rural areas.

	SuDS are always site specific, and require bespoke design that take into account the underlying hydrology, functional purposes of the area, and the present and future needs of people using the area.
White space	Areas of a map which have no information, i.e. gaps in a dataset.

13. References

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14. Appendices

Appendix A – List of available datasets provided by the local authority

Dataset	Last Updated
BAP 100m	July 2018
BAP 1km	April 2018
BAP Composite	April 2016
BAS Region	July 2016
CROW S15	No Date
Deciduous Woodland	Oct 2017
Habitat Region	September 2017
Habitat Region (line data)	September 2017
Invasive Species	Aug 2017
Land Classes	No Date
Protected Species 100m	May 2018
Protected Species 1km	April 2018
Protected Species Composite	March 2016
RIGS Region	Jan 2003
SBI Region	May 2016
SPD Staffs	No Date
Traditional Orchards	March 2006
Undetermined Grassland	January 2003
Nature Reserves	January 2015
Species Analysis	January 2018

Appendix B – Breakdown of Habitat Composite Region (including habitat data created for Part A of the brief)

Less than N years old	Data collection method	Cumulative Area (ha)	% of Lichfield area
5 years	Desk based	10966[4]	32.5%
	Ground truthed survey	45	0.1%
	Total	**11011**	**32.6%**
10 years	Desk based	10966	32.5%
	Ground truthed survey	1730	5.1%
	Total	**12696**	**37.6%**
15 years	Desk based	10966	32.5%
	Ground truthed survey	14134	41.9%
	Total	**25101**	**74.3%**
20 years	Desk based	17421	51.6%
	Ground truthed survey	15685	46.5%
	Total	**33106**	**98.0%**
25 years	Desk based	17421	51.6%
	Ground truthed survey	15840	46.9%
	Total	**33261**	**98.5%**
35 years	Desk based	17421	51.6%
	Ground truthed survey	15849	46.9%
	Total	**33270**	**98.5%**
unknown age	Desk based	450	1.3%
	Ground truthed survey	45	0.1%
	Total	**495.5254**	**1.5%**

[4] All of this habitat data is derived from habitat mapping completed for Part A of the brief of this report.

Appendix C – GIS datasets used in the generation of the NRN mapping for Lichfield District

Dataset	Used in	Justification	Limitations
Habitat Composite Region (including newly mapped areas as part of brief)	Strategic areas mapping. Habitat distinctiveness mapping	Provides complete coverage of the district	Wide range of ages and sources (See appendix 2) which may limit accuracy.
OS MasterMap	Creation of new habitat polygons for Part A of the brief – Phase 1 study.	Spatial information for each field parcel, house garden etc.	No 'habitat' data within the background table data.
Land Classification data	Defining 'Pasture and Arable' and 'Urban' areas in the Habitat Connectivity Opportunity areas.	Quickly and easily define 'habitat' for large areas of land.	Very broad scale areas, covering multiple fields etc.
Functional Ecological Units	Habitat Connectivity Opportunity mapping	Only current dataset which reflects the overall areas of influence for Meres and Mosses in Staffordshire.	
Species Data (Protected Notable BAP etc.) from Staffordshire Ecological Record (SER)	Provide detail of species presence in the Habitat Connectivity Opportunity mapping.	Most complete and up-to-date database of species records in the county.	Not a consistent survey – may be some species present which are missed.
Natural Englands Priority Habitat Inventories	Strategic Areas mapping, Habitat distinctiveness mapping, Habitat Connectivity Opportunity mapping	Identification of key habitat sites within the landscape to be conserved and connected. High value sites within the Habitat distinctiveness mapping.	
Local Wildlife Sites (LWS)	Strategic Areas mapping, Habitat distinctiveness mapping, Habitat Connectivity Opportunity mapping	Identification of key habitat sites within the landscape to be conserved and connected. High value sites within the Habitat distinctiveness mapping.	
Statutory sites maps (SSSI, SAC, RAMSAR etc.)	Strategic Areas mapping, Habitat distinctiveness mapping, Habitat Connectivity Opportunity mapping	Identification of key habitat sites within the landscape to be conserved and connected. High value sites within the Habitat distinctiveness mapping.	

British Geological Survey (BGS) Soil Property Data WMS	Habitat Connectivity Opportunity mapping	Scrutiny of modelling output of condatis for production of Habitat Connectivity Opportunity Areas ensuring that HCO is within the relevant soil type for that habitat based on the where habitats already exist on that soil type.	
Natural England National Character Areas (NCA)	Strategic Areas mapping, Habitat distinctiveness mapping, Habitat Connectivity Opportunity mapping	To ensure that the identified network aligns with national priorities for species, habitats and landscape.	
Staffordshire Biodiversity Action Plan (SBAP) Ecosystem Action Plan Areas (EAPS)	Habitat Connectivity Opportunity mapping	Ratification that the new Habitat Connectivity Opportunity areas are based on what has been identified as a priority in the SBAP.	

Appendix D – Evidence base confidence review (table supplied as a digital appendix)

Staffordshire Wildlife Trust (SWT)/Staffordshire Ecological Record (SER) hold and manage the a large quantity of the counties primary ecological data which is a key factor in being able to establish a robust evidence base for any strategic environmental work. It is critical that a thorough investigation of the available datasets both in-house and those available either through Open Government Licences, a Creative Commons open licence or via a paid licence subscription to ensure that we are using the best possible datasets in the creation of the NRN.

Desirability and reliability values were scored out of 10, a list of positive and negative indicators were used to define the values for each dataset. The desirability and reliability figures were then multiplied together to give the overall ‘confidence’ rating which is scored out of 100, the higher the score the higher the ‘confidence’ of the dataset contributing to a meaningful evidence base. It must however be noted that the dataset confidence ratings are only accurate to the time that they were produced, as new datasets become available and the existing datasets are updated the confidence ratings will alter to reflect any relevant changes. The inventory therefore must be kept up to date and reviewed prior to starting any future large scale projects to ensure that the best evidence base is being used.

Appendix E – Breakdown of habitats and sites included in the habitat distinctiveness mapping bands

Distinctiveness Band	Habitats included within the band	Action (in order of preference)
Very High	● Irreplaceable habitats (e.g. ancient woodland) ● International, national or regional value species populations. ● Priority habitats as defined in Section 41 of the Natural Environment and Rural Communities (NERC) Act that are highly threatened, internationally scarce and require conservation action e.g. blanket bog	Avoid loss, Enhance, Link, Create new habitat adjacent (expand existing habitat)
High	● County and district value ● Habitats known to support county and district value species populations. E.g. all rivers and good quality streams. ● Priority habitats as defined in Section 41 of the NERC Act requiring conservation action e.g. lowland fens	Avoid loss, mitigate loss, last resort compensate loss. Enhance, link and create new habitat.
Medium	● Local Value ● Habitats of Principal Importance and Staffordshire Biodiversity Action Plan (SBAP) habitats that don't meet LSW criteria, semi-natural habitats that act as corridors and stepping stones, arable land which is in a relevant stewardship agreement or organic status. ● Local Value species populations. ● E.g. hedges, ponds, copses and low quality woodland, rough grassland, ruderal vegetation, degraded watercourses/ditches. Habitats known to support priority species. Buildings with protected species presence that aren't high value. ● Semi-natural vegetation not classed as a priority habitat e.g. hazel scrub	Mitigate loss, compensate loss. Enhance, link and create new habitat.
Low	● Site Value ● Intensive arable, improved and amenity grassland, manicured landscaping, isolated poor semi-natural habitat. ● Semi-natural or modified vegetation not classed as a priority habitat and of lower relative value to most wildlife e.g. Temporary grass and clover ley; intensive orchard; rhododendron scrub	Compensate large losses. Enhance, link and create new habitat.
Very Low	● Buildings (unless supporting protected/priority species), hard standing, roads, regularly disturbed bare ground. ● Habitats and land cover or little or no value to wildlife e.g. Developed land sealed surface	Create new habitat where connectivity exists or functional size is achievable.

The mapping works by assessing the proportion of broad habitats e.g. woodland, grassland, heathland etc. within an area to determine whether these are ‘strategic’, ‘semi-strategic’ or ‘non-strategic’

Ordnance Survey 1km grid squares were classified based on the principle that if 20% or more of that square has, for instance woodland habitat within it then it is considered to function ecologically (species associated with that habitat are able to move freely within this square). Based on the above, classification of 1km squares are defined as:

- Strategic: between 5-20% of the 1km square is covered by a habitat e.g. woodland/grassland. Priority as this requires further habitat to reach the 20% threshold to be considered ‘ecologically functional’ for that specific habitat.
- Semi-strategic: 20% or greater specific habitat in the 1km square. Already meets the 20% threshold to be considered ‘ecologically functional’ but the creation of further habitat will strengthen ability for species to be able to exist and move through this square.
- Non-strategic: less than 5% of the 1km square is covered by a specific habitat making it too onerous to bring the amount of habitat to meet the 20% threshold, it is therefore not a priority area to target biodiversity compensation.

Strategic area mapping is carried out on a per habitat basis, e.g. a strategic areas map is produced for each habitat analysed, however an overall strategic areas map has been produced based on the combination of all the habitats analysed as part of the strategic mapping exercise (map 2). For this map, the methodology has been altered so that the criteria for strategic and semi-strategic areas have been swapped e.g. anything with over 20% habitat coverage is now considered strategic. By altering the methodology in this way it is possible to create a coarse overall ‘connectivity map’ by highlighting the areas with highest combined overall habitat availability and connectivity as opposed to those areas where it is best to create habitats.

As only higher quality habitats are assessed through this analysis (e.g. species rich grassland) and lower quality habitats are not included (table F1) (e.g. improved grassland or poor semi-improved grassland) as they do not adequately contribute to the network as they cannot support the same level of species diversity as higher quality habitats and therefore would not be able to support this diversity. This is not to say that these habitats do not contribute to the network in some way but are not presently of a high enough biodiversity value to act as a potential source site for biodiversity or to support species typical of that habitat indefinitely.

It is important to note that updating the strategic area maps over time requires up-to-date mapping data which should be sent to the Local Environmental Records Centre (LERC) when available in a suitable format to incorporate into the Nature Recovery Network Mapping.

Table F1 – Habitat types included in the assessment of strategic habitat areas (habitats without an 'X' in a relevant habitat column were not used in the assessment).

Habitat survey type	HABCODE	Habitat description	Woodland	Wetland	Grassland	Heathland
UKBAP	CF1	Coastal floodplain grazing marsh		X	X	
UKBAP	WW	Wet Woodland (Where identified)	X	X		
Phase 1	A111	Broad-leaved semi-natural woodland	X			
Phase 1	A112	Broad-leaved plantation	X			
Phase 1	A121	Coniferous semi-natural woodland	X			
Phase 1	A122	Coniferous plantation	X			
Phase 1	A131	Mixed semi-natural woodland	X			
Phase 1	A132	Mixed plantation	X			
Phase 1	A21	Dense continuous scrub	X			
Phase 1	A22	Scattered scrub	X		X	
Phase 1	A31	Broad-leaved parkland/scattered trees	X		X	
Phase 1	A32	Coniferous parkland/scattered trees	X		X	
Phase 1	A4	Recently felled woodland				
Phase 1	A5	Orchard	X		X	
Phase 1	B11	Unimproved acidic grassland			X	
Phase 1	B12	Semi-improved acidic grassland			X	
Phase 1	B21	Unimproved neutral grassland			X	
Phase 1	B22	Semi-improved neutral grassland			X	
Phase 1	B31	Unimproved calcareous grassland			X	
Phase 1	B32	Semi-improved calcareous grassland			X	
Phase 1	B4	Improved grassland				
Phase 1	B5	Marsh/marshy grassland		X	X	
Phase 1	B6	poor semi-improved grassland				
Phase 1	C11	Continuous bracken				
Phase 1	C31	Tall ruderal			X	
Phase 1	C32	Non-ruderal				
Phase 1	D11	Acid Dry dwarf shrub heath				X
Phase 1	D2	Wet dwarf shrub heath				X
Phase 1	D3	Lichen/bryophyte heath				X
Phase 1	D4	Montane heath/dwarf herb				X
Phase 1	D5	Dry heath/acidic grassland mosiac			X	X
Phase 1	D6	wet heath/acid grassland mosaic				X
Phase 1	E11	Sphagnum Bog		X		
Phase 1	E2 (any)	Flush and Spring		X	X	
Phase 1	E3 (any)	Fen		X	X	
Phase 1	F (any)	Swamp, marginal and innundation		X		
Phase 1	G (any)	Open Water		X		
Phase 1	I21	Quarry				
Phase 1	I22	Spoil				

Phase 1	I24	Refuse tip				
Phase 1	J11	Arable				
Phase 1	J112	Allotments				
Phase 1	J113	Set-aside (field margins)			X	
Phase 1	J12	Amenity grassland				
Phase 1	J13	Ephemeral/short perennial				
NVC	A (Any)	Aquatic Communities		X		
NVC	CG02	Festuca ovina–Avenula pratensisgrassland			X	
NVC	CG03	Bromus erectusgrassland			X	
NVC	CG07	Festuca ovina–Hieracium pilosella–Thymus praecox/pulegioides grassland			X	
NVC	H08	Calluna vulgaris–Ulex galliiheath				X
NVC	H09	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H09/MG 10	Calluna vulgaris–Deschampsia flexuosa heath / Holcus lanatus–Juncus effususrush-pasture		X	X	X
NVC	H09/U05	Calluna vulgaris–Deschampsia flexuosa heath / Nardus stricta–Galium saxatilegrassland			X	X
NVC	H09/U2	Calluna vulgaris–Deschampsia flexuosa heath / Deschampsia flexuos agrassland			X	X
NVC	H09a	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H09b	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H09c	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H09e	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H12	Calluna vulgaris–Vaccinium myrtillus heath				X
NVC	H12a	Calluna vulgaris–Vaccinium myrtillus heath				X
NVC	H12c	Calluna vulgaris–Vaccinium myrtillus heath				X
NVC	M22	Juncus subnodulosus–Cirsium palustre fen-meadow		X		
NVC	M23	Juncus effusus/acutiflorus–Galium palustrerush-pasture		X		
NVC	M24	Molinia caerulea–Cirsium dissectumfen-meadow		X		
NVC	M25	Molinia caerulea–Potentilla erectamire		X		
NVC	M26	Molinia caerulea–Crepis paludosa mire		X		
NVC	MG04	Alopecurus pratensis–Sanguisorba officinalis grassland			X	
NVC	MG05	Cynosurus cristatus–Centaurea nigragrassland			X	
NVC	MG08	Cynosurus cristatus–Caltha palustris grassland			X	
NVC	MG09	Holcus lanatus–Deschampsia cespitosa grassland			X	
NVC	MG10	Holcus lanatus–Juncus effusus rush-pasture		X	X	
NVC	S (Any)	Salt-marsh communities		X		
NVC	U01	Festuca ovina–Agrostis capillaris–Rumex acetosella grassland			X	
NVC	U02	Deschampsia flexuosa grassland			X	
NVC	U03	Agrostis curtisii grassland			X	
NVC	U04	Festuca ovina–Agrostis capillaris–Galium saxatilegrassland			X	
NVC	W (any)	Woodlands and Scrub	X			

Condatis works by modelling a landscape of habitats as if it were an electrical circuit. A circuit board consists of a number of wires joining up resistors in combinations. When a voltage is applied to the board at one end, the current will pass through the board to the other end but the amount of current passing through each wire will vary according to the resistances it meets through each pathway. Condatis considers a landscape as analogous to a circuit board, with a source population of species being considered the voltage, the links between habitat useable by these species being the resistors, and the flow of species colonising the available habitat across those links being considered the current. Condatis is able to measure the flow of a hypothetical species across a landscape based on the availability of a distinct habitat category e.g. woodland or grassland.

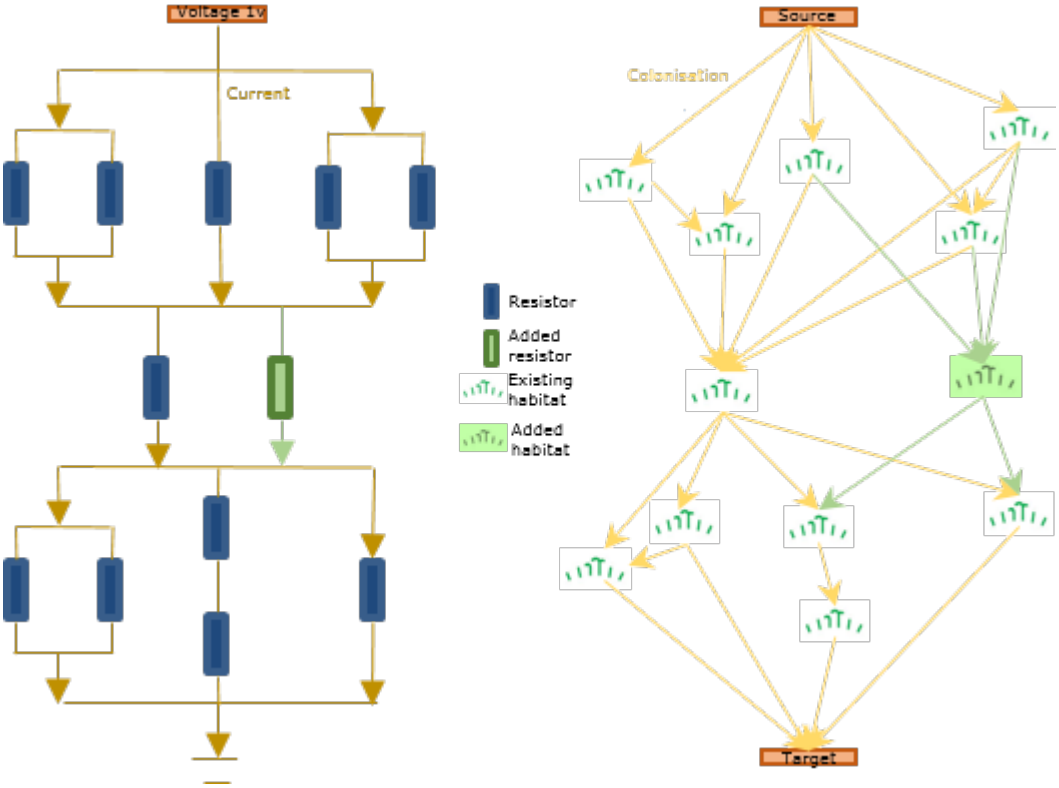


Image 1 Electrical circuit on the left and comparable stylised habitat map on the right. Green represents adding a resistor or additional habitat to each to increase the number of pathways available and therefore improve the flow. Image available at: http://wordpress.condatis.org.uk/

Habitat source and target locations are specified: the source either representing a nominal population of species or an actual population (in this case a nominal population was used), the target representing an area for eventual colonisation. The direction of travel is defined by the placement of source and target and will depend on the purpose of study. For instance, if looking at likely species movement due to climate change, a south to north or lowland to upland direction might be required. A South-north orientation was chosen for the source and target to reflect the likely species movement change in response to climate change. Condatis looks at how the habitat in between the source and target could contribute to the species progress over multiple generations, so it is not designed to look in detail at individual patch-to-patch movements.

By using Condatis to output the relative flow of a species through the landscape for a given habitat type it is possible to more accurately define where wildlife corridors exist and where they could be improved.

- The mapping takes into account existing local wildlife-rich habitats and existing ecological networks as well as local national and internationally designated nature conservation sites.

- The aim of the HCO areas is not to replace large areas of farmed land; we must continue to rely on working with farmers and landowners to manage existing habitats and create areas of new habitat.

- Developments whose primary objective is to conserve or enhance biodiversity particularly those which are aligned with the opportunity areas should be supported, and opportunities to incorporate biodiversity improvements in and around developments should be encouraged especially where this benefits overall biodiversity and habitat connectivity for example the creation of species rich grassland within the grassland opportunity area.

- When delivering against the mapping, care should be taken to ensure that the best possible habitat for that area is being created; it may be tempting for example where an area is both within a connectivity zone for woodland and grassland to plant large tracts of woodlands as this is easiest and most cost effective when in fact this may in some cases may result in the loss of important habitats whereas species rich grassland enhancement would be both more beneficial and provides better outcomes for habitat connectivity.

- The main aims are to ensure adequate habitats are large enough to resist harmful effects, and are well-enough connected to ensure that species are able to move around and sustain populations. Harmful effects may be localised, e.g. flooding or be much more far-reaching for example climate change. The need for more, bigger, better and joined up habitats is explained in detail in Lawton et al. (2010).

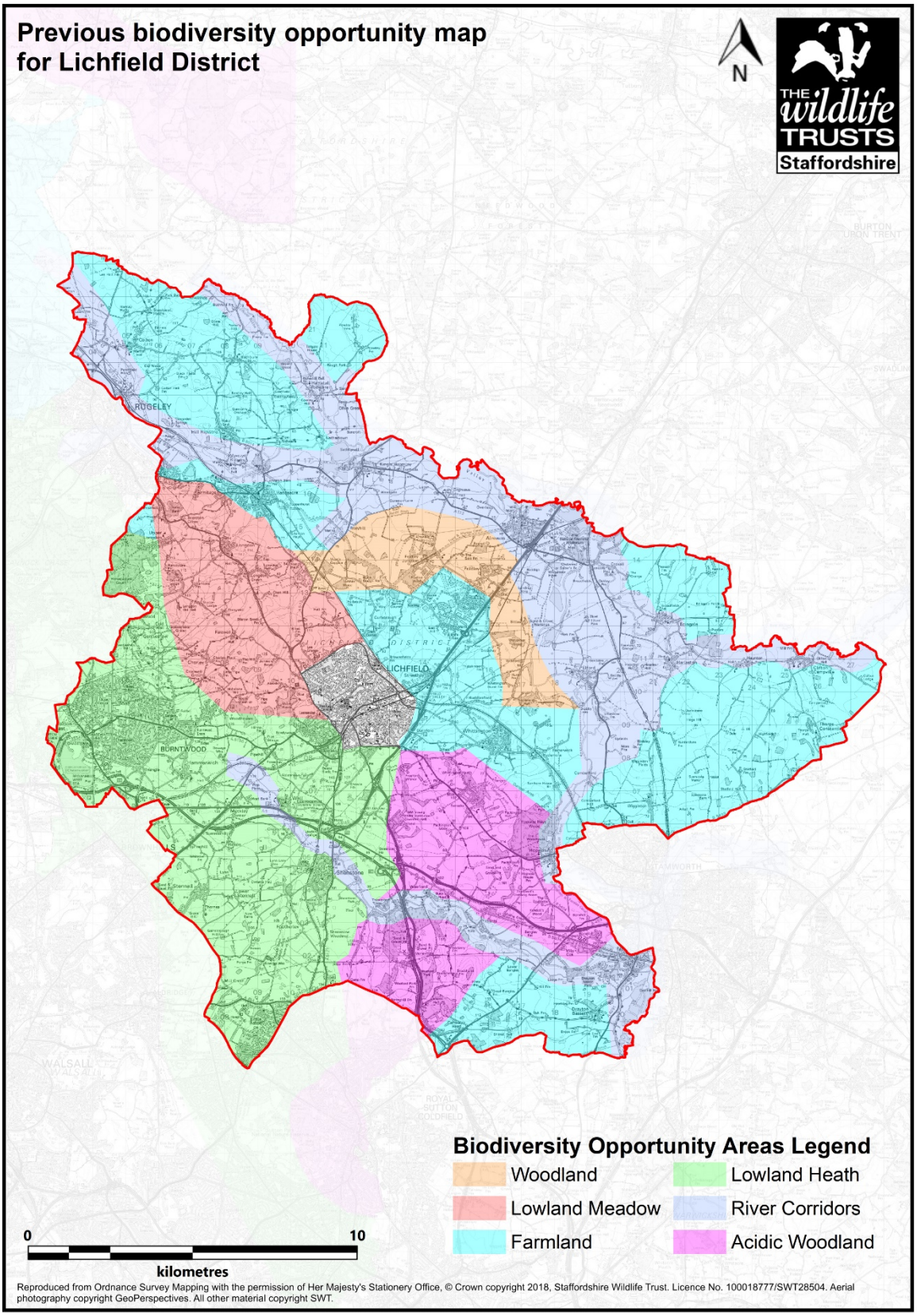
- The opportunity areas reflect and refine the work of the Staffordshire Biodiversity Action Plan Ecosystem Action Plan areas (appendix 11) by using finer detail data to pick out more targeted conservation areas.

- The habitat connectivity opportunity areas were cross-referenced against the previously mapped biodiversity opportunity zones detailed in LDCs Biodiversity & Development Supplementary Planning Document (2016). The habitat connectivity opportunity areas are more refined than the previously mapped opportunity zones but do reflect similarities within the landscape.

- Habitat creation and restoration should take into account landscape considerations, geology and the historic environment. Particular care will be required where intensive methods are required, such as topsoil stripping / deep ploughing, or where the effect, such as woodland planting is likely to be visible from settlements or rights of way.

- Habitat creation or restoration may create opportunities too, for example screening unsightly features, creating geological exposures or helping conserve historic features.

- Regular updates of the maps is required to reflect any changes in mapped habitats as a result of physical habitat changes on the ground.


Previous biodiversity opportunity map
for Lichfield District
N
THE wildlife TRUSTS
Staffordshire
RUGELEY
LICHFIELD
BURNTWOOD
Biodiversity Opportunity Areas Legend
Woodland
Lowland Heath
Lowland Meadow
River Corridors
Farmland
Acidic Woodland
0
10
kilometres
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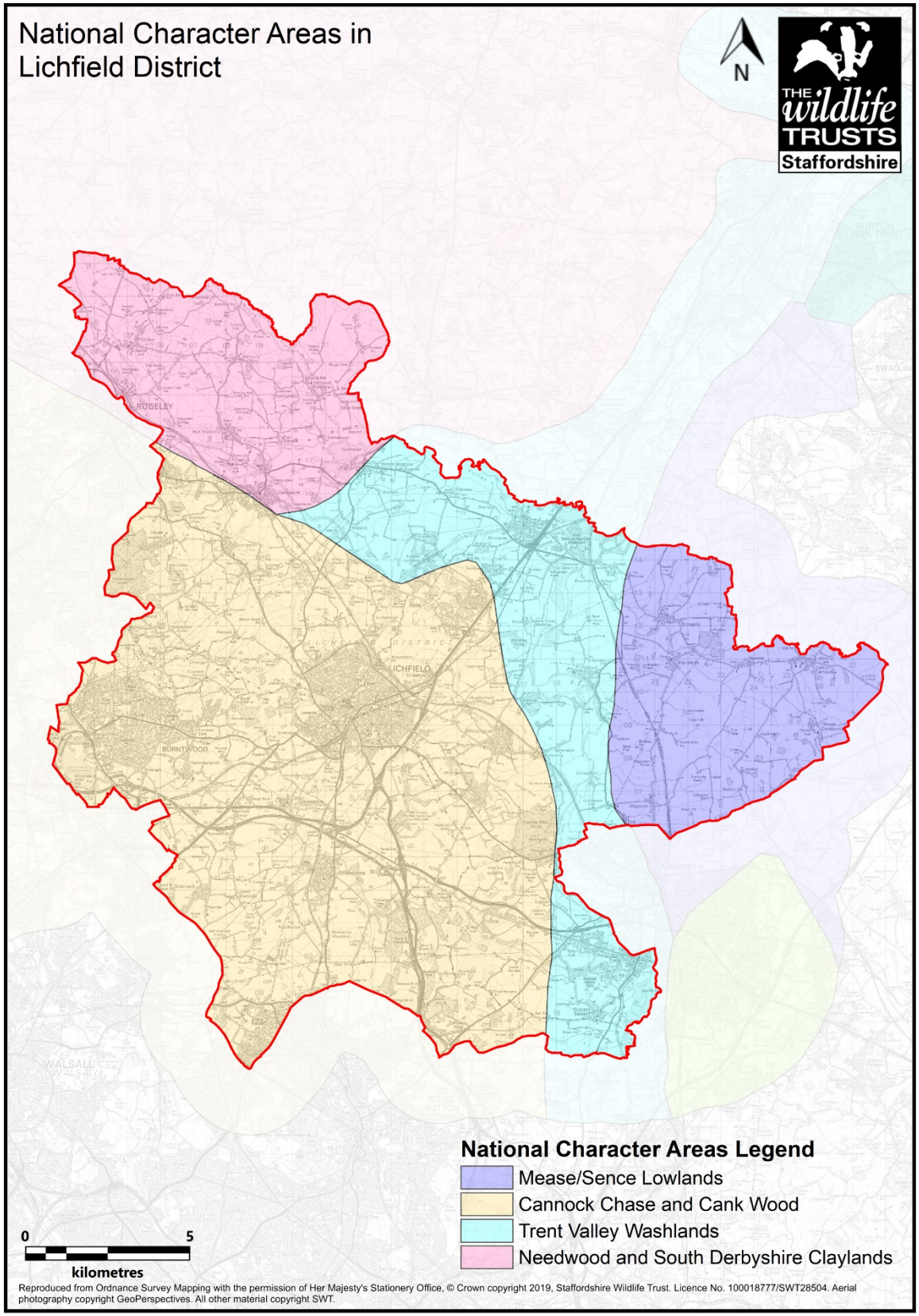
Appendix J – National Character Areas (NCA) in Lichfield District (NCA boundaries © Natural England)



Appendix K – Staffordshire Biodiversity Action Plan (SBAP) Ecosystem Action Plan Areas (EAPs) within Lichfield District (2019)