

**Shropshire Climate Action  
Partnership**

# **Shropshire Renewable Energy Opportunity Map Method Report**

**Draft report**  
Prepared by LUC  
October 2021



## Shropshire Climate Action Partnership

### Shropshire Renewable Energy Opportunity Map Method Report

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# Chapter 1

## Introduction

**1.1** Shropshire Climate Action Limited, the trading arm of Shropshire Climate Action Partnership (SCAP), commissioned LUC to produce county-wide solar and wind renewable energy opportunity maps for the geographic county of Shropshire. SCAP was formed in 2020 to create a Zero Carbon Shropshire Plan. This Plan, as published in January 2021, outlines the need for Shropshire to become carbon neutral by 2030 and sets out recommendations for actions to achieve this.

**1.2** The maps provide a consistent and robust evidence base that will help SCAP to demonstrate to grid operators, potential developers, major energy users and other stakeholders what future infrastructure will be needed to support the journey towards net zero carbon Shropshire by 2030. The maps also show where the opportunities arise for ground-mounted solar and wind farm development, with the aim of helping inform planning decisions to provide a strategic approach to energy development in Shropshire and to promote the development of the local energy industry.

**1.3** This study comprises the first phase of a programme of work developing full energy mapping for Shropshire. This will map future demand and supply anticipated to be needed over the coming decade to 31 December 2030, with associated grid constraints and opportunities, to help plan for the development of the local energy industry for decarbonising residential, industrial and other energy use.

**1.4** This report outlines the methodology used to produce the strategic maps, and identifies where further site-specific work will be required in order to determine the feasibility of individual sites for wind or ground-mounted solar energy developments. It also estimates the generation potential of ground-mounted solar and wind within Shropshire.

**1.5** The remainder of this report is structured as follows:

- **Chapter 2** outlines the methodology used to undertake the mapping analysis.
- **Chapter 3** outlines the findings of the analysis.
- **Chapter 4** sets out how SCAP can take the findings of this study forward.
- **Appendix A** sets out the assumptions used in the assessment of wind energy development potential.
- **Appendix B** sets out the assumptions used in the assessment of ground-mounted solar energy development potential.

## Chapter 2

### Method

**2.1** This chapter outlines the assumptions used to identify land with technical potential for ground-mounted solar and wind energy developments. It also sets out the approach to calculating generation potential and the limitations of the study.

**2.2** The 'technical potential' is the total amount of renewable energy that could be delivered in the area based on assumptions regarding the amount of natural resource and space available once land use constraints are removed. This differs to the 'deployable potential', which estimates what could realistically be delivered when also taking into consideration factors such as planning issues, economic viability, availability of grid connections and landscape sensitivity. Although this study identifies locations that have potential to be more appropriate in terms of constraints and opportunities for ground-mounted solar and wind generation, to determine the full deployable potential of renewables within Shropshire would require further study beyond the scope of this high-level assessment.

### Ground-mounted solar PV

#### Description of technology

**2.3** In addition to PV modules integrated with built development, there are a large number of stand-alone ground-mounted solar PV arrays or solar farms within the UK. These consist of groups of panels (generally arranged in linear rows) mounted on frames supported above the ground by lightweight structures. Due to ground clearance and spacing between rows (and between rows and field boundary features) solar arrays do not cover a whole field and allow vegetation to continue to grow between and even underneath the panels.

**2.4** Ground-mounted solar project sizes vary greatly across the UK although developers in the post- FIT subsidy environment are increasingly focusing on large-scale development, with the largest currently consented scheme in England (Cleve Hill in Kent) being over 350 MW<sup>1</sup> of installed generation capacity. There is no one established standard for land 'take' per MW of installed capacity, although land requirements for solar are comparatively high compared with wind. For the present assessment, an approximate

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<sup>1</sup> Cleve Hill Solar Park (2020) Cleve Hill Solar Park granted development consent – 28/05/2020. Available at: [www.clevehillsolar.com/](http://www.clevehillsolar.com/).

requirement of 2.4ha (0.024km<sup>2</sup>)<sup>2</sup> per MW has been applied based on existing and past guidance and recent development experience.

**2.5** As of 2020, the UK had 13,563 MW of installed solar PV capacity, with this providing 12,801 GWh of electricity during the year<sup>3</sup> (the lower energy generation relative to wind – see paragraph 2.18 – despite the similar installed capacity is due to the lower capacity factors of solar PV generation – see paragraph 2.11). These figures include all forms of solar PV – although according to the most recent available data, ground-mounted schemes account for 50.2% of overall capacity<sup>4</sup>. Falling capital costs are rendering solar PV increasingly viable in a post-subsidy context, although as outlined above, at present developers are generally focusing on large developments in order to achieve economies of scale. Grid connection costs are also critical to determine viability.

### Existing development within Shropshire

**2.6** The data available from the department for Business, Energy and Industrial Strategy (BEIS)<sup>5</sup> identifies there is 246.7MW of ground-mounted solar PV currently consented or installed in Shropshire. In addition, this identifies one 4.7MW scheme that was withdrawn, one 2MW scheme that was abandoned, and schemes totalling 73MW that were refused planning consent, including the 30.5MW Sheriffhales Solar Farm near Shifnal. Of these refused schemes, two have since been resubmitted and are now operational: the 5MW Ebnal Lodge Solar Farm and the 6.5MW Henley Solar Farm.

### Assumptions used to identify land with technical potential

**2.7** The assessment of technical potential for solar development was undertaken using Geographical Information Systems (GIS). The assessment identified areas with financially viable solar irradiance levels (amount of sunlight) for PV. A series of primary constraints relating to physical features and environmental/heritage protection were then removed. The remaining areas are deemed to have 'technical potential' for ground-mounted solar energy development.

**2.8** Solar development is more 'modular' than wind (development size is dictated by the number of panels, which

themselves do not differ greatly in size) and constraints are not affected by project scale in the way that they are for wind. Therefore, the identification of available land for ground-mounted solar has not been broken down into discrete project sizes but rather any land technically suitable for development has been identified.

**2.9** The key constraints and opportunities considered are set out in **Table A - 1** in **Appendix A**.

**2.10** Unconstrained areas of land were then excluded if they were below a minimum developable size of 1ha (0.01km<sup>2</sup>)<sup>6</sup>.

### Calculation of generation potential within Shropshire

**2.11** As the full technical potential for ground-mounted solar generation is very large, utilisation of 1%, 3% and 5% of the resource is quantified. The calculation of potential energy yield then requires application of a 'capacity factor' i.e. the average proportion of maximum PV capacity that would be achieved in practice over a given period. Capacity factors vary in practice in accordance with solar irradiation, which in turn is affected by location, slope and aspect. It was not possible to find suitable historic data on capacity factors taking into account these kinds of variations within Shropshire for the present study, and so a single capacity factor of 9.9% was used, as based on regional data for the West Midlands<sup>7</sup>.

**2.12** In addition, the potential carbon savings as a result of generation via the identified ground-mounted solar potential were calculated. This assumed that the electricity generated from the identified ground-mounted solar potential would result in negligible carbon emissions and would replace that currently provided by the national grid, which has an emission factor of 0.233 kgCO<sub>2</sub>e/kWh<sup>8</sup>, this being the national average over all types of generation in use.

## Wind

### Description of technology

**2.13** Onshore wind power is an established and proven technology with thousands of installations currently deployed

<sup>2</sup> Note: 1km<sup>2</sup> = 100ha = 247 acres.

<sup>3</sup> Department for Business, Energy & Industrial Strategy (March 2021) Energy Trends: UK renewables: Table 6.1 - Renewable electricity capacity and generation (ET 6.1 - quarterly). Available at: [www.gov.uk/government/statistics/energy-trends-section-6-renewables](http://www.gov.uk/government/statistics/energy-trends-section-6-renewables).

<sup>4</sup> Department for Business, Energy & Industrial Strategy (May 2021) Solar photovoltaics deployment: Using March 2021 data within Table 2, considering all FITs (standalone), RO (ground mounted) and CfDs (ground-mounted) within the UK. Available at: [www.gov.uk/government/statistics/solar-photovoltaics-deployment](http://www.gov.uk/government/statistics/solar-photovoltaics-deployment).

<sup>5</sup> BEIS (2021) Renewable Energy Planning Database (REPD): March 2021. Available at:

<https://www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract>.

<sup>6</sup> Based on knowledge of commercial renewable developer industry practice.

<sup>7</sup> BEIS (2020) Quarterly and annual load factors: Annual Regional PV Load Factors, averaged at 9.9% for the West Midlands region over the last nine years. Available at:

<http://www.gov.uk/government/publications/quarterly-and-annual-load-factors>.

<sup>8</sup> BRE (2019) Standard Assessment Procedure (SAP 10). Available at: <https://www.bregroup.com/sap/sap10/>.

across many countries throughout the world. The UK has the largest wind energy resource in Europe.

**2.14** Turbine sizes do not fall intrinsically into clear and unchanging categories. At the largest scale, turbine dimensions and capacities are evolving quite rapidly. The deployment of turbines at particular ‘typical’ scales in the past has also been influenced by changing factors which include the availability of subsidies of different kinds. As defined scales need to be applied for the purpose of the resource assessment, the assessment has used five size categories based on consideration of current and historically ‘typical’ turbine models:

- Very large (150-200m tip height)
- Large (100-150m tip height)
- Medium (60-100m tip height)
- Small (25-60m tip height)
- Very small (<25m tip height)

**2.15** An assessment of technical potential for very small wind (<25m height) was not undertaken as it is not possible to define areas of suitability for these using the same assessment criteria. Notional turbine sizes for the purposes of the present resource assessment are approximately intermediate within each class size (**Table 2.1**).

*Table 2.1: Notional turbines used for this resource assessment*

| Scale      | Typical Turbine Installed Capacity | Typical Turbine Height (maximum to blade tip) |
|------------|------------------------------------|---|
| Very large | 4MW                                | 175m  |
| Large      | 2.5MW                              | 125m  |
| Medium     | 500kW                              | 80m   |
| Small      | 50kW                               | 45m   |

**2.16** Most turbines above the smallest scales have a direct connection into the electricity distribution network, at a point in the ‘national grid’ structure that can accommodate their output. Smaller turbines may provide electricity for single premises via a ‘private wire’ (e.g. a farm or occasionally a large energy user such as a factory), or be connected to the grid directly for export into the national system. Typically, turbines will be developed in larger groups (wind farms) only at the larger

scales. The amount of energy that turbines generate will depend primarily on wind speed but will be limited by the maximum output of the individual turbine (expressed as ‘installed capacity’ in **Table 2.1**).

**2.17** A review of wind turbine applications across the UK found that tip heights range from less than 20m up to around 200m, with larger turbine models particularly in demand from developers following the reduction in financial support from Government. The majority of operational and planned turbines range between 80m and 175m, with the majority at the larger end of the scale.

**2.18** As of 2020, the UK had 14,282 MW of installed onshore wind capacity, providing 34,948 GWh electricity during the year<sup>9</sup>. Since the removal of financial support and the restrictive policy requirements in the National Planning Policy Framework (NPPF), onshore wind development activity has moved overwhelmingly away from England towards Scotland and Wales (and possibly offshore), where it is focusing particularly on sites with high wind speeds and the ability to accommodate larger numbers of tall turbines.

### Existing development within Shropshire

**2.19** According to the most recent BEIS Renewable Energy Planning Database<sup>10</sup>, there are no consented or operational wind developments within Shropshire. The 14MW Poplar Lane Wind Farm was refused planning permission and the application for the 3MW wind development at Criddon Hall Farm was withdrawn.

### Assumptions used to identify land with technical potential

**2.20** The assessment of technical potential for very large, large, medium and small turbines was undertaken using GIS using a similar approach to that used for ground-mounted solar development. The assessment identified areas with viable wind speeds (applying a reasonable but relatively generous assumption in this respect, bearing in mind that only the highest wind speeds are potentially financially viable at the present time) and the number of turbines that could be theoretically deployed within these areas. A series of primary constraints relating to physical features and environmental/heritage protection were then applied. As Shropshire is located adjacent to the Welsh border and the primary constraints included wind turbine physical safety buffers that could extend beyond the county, both English and

<sup>9</sup> Department for Business, Energy & Industrial Strategy (March 2021) Energy Trends: UK renewables: Table 6.1 - Renewable electricity capacity and generation (ET 6.1 - quarterly). Available at: [www.gov.uk/government/statistics/energy-trends-section-6-renewables](https://www.gov.uk/government/statistics/energy-trends-section-6-renewables).

<sup>10</sup> BEIS (2021) Renewable Energy Planning Database (REPD): March 2021. Available at: <https://www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract>.

Welsh constraints were considered. The remaining areas have 'technical potential' for wind energy development.

**2.21** The key constraints considered are set out in detail in **Table B - 1** in **Appendix B**.

**2.22** Unconstrained areas of land were then excluded if they were below a minimum developable size<sup>11</sup>. This varied with turbine size:

- Very large: 0.8ha (0.008km<sup>2</sup>)
- Large: 0.6ha (0.006km<sup>2</sup>)
- Medium: 0.4ha (0.004km<sup>2</sup>)
- Small: 0.2ha (0.002km<sup>2</sup>)

### Calculation of generation potential within Shropshire

**2.23** The analysis examined the potential for very large, large, medium and small turbines. Where potential existed for more than one size of turbine, it was assumed that the larger turbines would take precedence i.e. it was assumed that the largest potential turbine in each case would be installed. This was to calculate the most realistic technical potential for wind, as to ensure viability, developers usually seek to install the largest capacity turbines.

**2.24** The calculation of potential wind capacity involved applying an assumption concerning development density. In practice, turbines are spaced within developments based on varying multiples of the rotor diameter length. Although turbine separation distances vary, a 5 x 3 rotor diameter oval spacing, with the major axis oriented 135° (greater in the prevailing wind direction, taken to be southwest as the 'default' assumption in the UK) was considered a reasonable general assumption at the present time in this respect. In practice, site-specific factors such as prevailing wind direction and turbulence are taken into account by developers, in discussion with turbine manufacturers. Bearing in mind the strategic nature of the present study, the density calculation did not take into account the site shape, and a standardised density was used instead:

- Very large: 2 turbines per km<sup>2</sup> (per 100ha)
- Large: 6 turbines per km<sup>2</sup> (per 100ha)
- Medium: 20 turbines per km<sup>2</sup> (per 100ha)
- Small: 182 turbines per km<sup>2</sup> (per 100ha)

**2.25** The calculation of potential energy yield then required application of a 'capacity factor' i.e. the average proportion of maximum turbine capacity that would be achieved in practice over a given period. Capacity factors vary in practice in accordance with wind speed, terrain and turbine scale. It was not possible to find suitable historic data on capacity factors, taking into account these kinds of variations in Shropshire for the present study, and so a single capacity factor of 17.4% was used for all turbine scales, as based on regional data<sup>12</sup>.

**2.26** In addition, the potential carbon savings as a result of generation via the identified wind potential was calculated. This assumed that the electricity generated from the identified wind potential would result in negligible carbon emissions and would replace that currently provided by the national grid, which has an emission factor of 0.233 kgCO<sub>2</sub>e/kWh<sup>13</sup>.

### Assumptions used to prioritise identified land with technical potential

**2.27** To assist developers and other stakeholders to organise the identified land parcels suitable for ground-mounted solar and wind generation in terms of their relative merits, areas were scored based on their proximity to features that might influence their developability. Whilst it is an arbitrary radius, a search area of 1km around features that may influence developability has been used to accumulate a total secondary consideration score and a total secondary opportunity score to sort the identified land parcels. This radius varies for some of the considerations as set out in **Table A - 2** and **Table A - 3** in **Appendix A** for ground-mounted solar and **Table B - 2** and **Table B - 3** in **Appendix B** for wind.

**2.28** In addition to the above, further opportunities were also mapped, indicating where identified land with technical potential may have greater potential to be deployable (see **Table A - 4** in **Appendix A** for ground-mounted solar and **Table B - 4** in **Appendix B** for wind). However, this did not form part of the main secondary opportunities mapping as either data was not suitable or opportunities should be considered only at site level.

**2.29** As Shropshire is located adjacent to the Welsh border and these arbitrary radiuses surrounding considerations and opportunities could extend beyond the county, both English and Welsh datasets were considered.

<sup>11</sup> Based on knowledge of renewable developer industry practice.

<sup>12</sup> BEIS (2020) Quarterly and annual load factors: Annual Regional Wind Load Factors, averaged at 17.4% for the West Midlands region over the last six years. Available at:

<http://www.gov.uk/government/publications/quarterly-and-annual-load-factors>.

<sup>13</sup> BRE (2019) Standard Assessment Procedure (SAP 10). Available at: <https://www.bregroup.com/sap/sap10/>.

## Limitations

**2.30** The paragraphs below outline the limitations of the work undertaken, which need to be considered when interpreting the results and maps produced by this work.

### Open data

**2.31** Only openly available data was used as part of this study. Purchased data could in some cases provide more accurate details of potential constraints to ground-mounted solar and wind energy developments.

**2.32** In addition, no local authority data (with the exception of the openly available brownfield land sites point dataset) were used as part of the study. Therefore, future work would be required to determine how Local Plan policies and allocations may impact the suitability of sites for development.

### Point and line data

**2.33** As noted in **Appendix A** and **Appendix B**, some of the datasets used as part of this work were only available in point or line format e.g. listed building points and road lines. As a result, buffers were applied to these features to estimate their 'footprint', e.g. listed building footprints and road widths, based on the professional knowledge and experience of LUC and are outlined in the appendices. Further site-specific work would be required to determine the exact sizes of such features and how this may impact the potential to deliver ground-mounted solar and wind energy developments.

### Buffer distances

**2.34** The safety buffer distances surrounding features used as part of the primary constraints to ground-mounted solar and wind developments were informed by standard industry practice, as outlined in **Table A - 1** in **Appendix A** and **Table B - 1** in **Appendix B**.

**2.35** However, as stated in paragraph 2.27 above, an arbitrary radius of 1km around features that may influence developability was used to organise land parcels in terms of their relative merits with regards to potential secondary considerations and opportunities for development. Site-specific studies would be required to determine the suitability of land for ground-mounted solar and wind energy development in proximity to these features. For example, some biodiversity designations may not be sensitive to wind developments within 1km, whereas some may be sensitive to wind developments over greater distances.

### Study scale

**2.36** This work has been undertaken at the geographical county-wide scale and identifies the strategic potential for ground-mounted solar and wind energy developments. There

are numerous smaller-scale factors that would require further site-specific assessment in order to determine the suitability of individual sites for ground-mounted solar and wind energy developments.

# Chapter 3

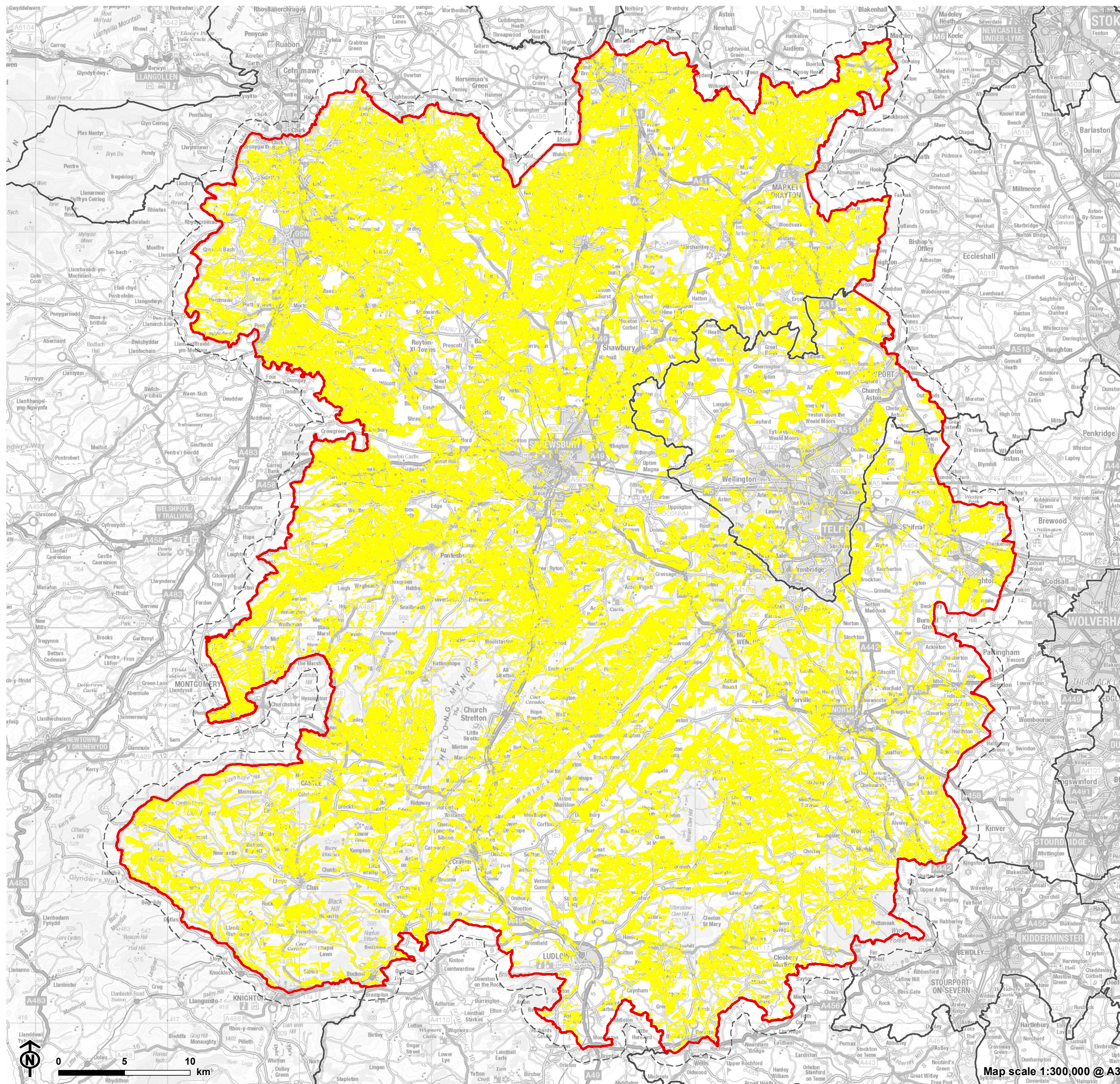
## Results

### Ground-mounted solar potential

**3.1** Following application of the method outlined in **Chapter 2**, the following maps were produced:

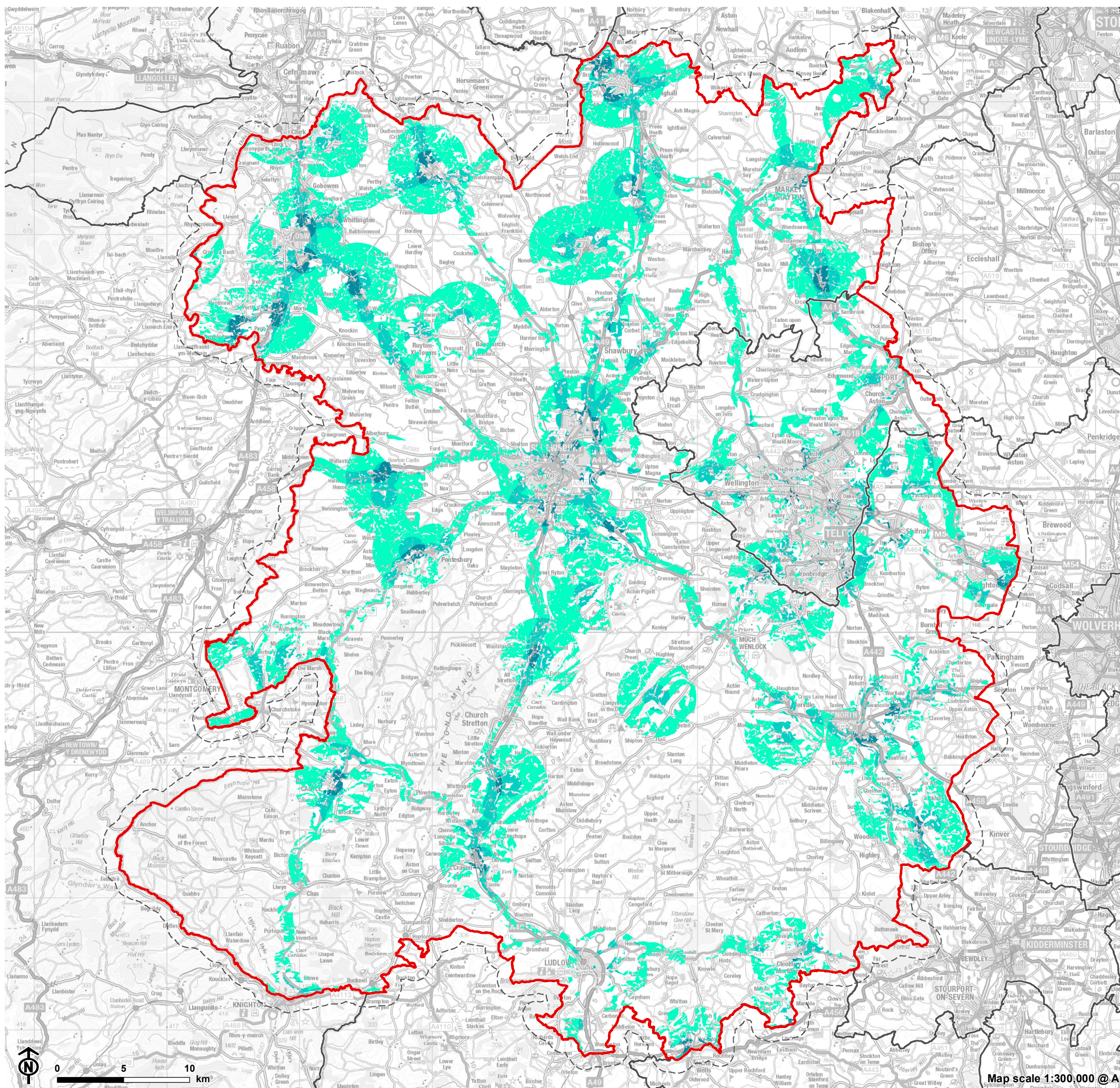
- **Figure 3.1** presents all land that is technically suitable for ground-mounted solar PV development.
- **Figure 3.2** presents the number of secondary opportunities within the land that is technically suitable for ground-mounted solar PV development that is within an area of greater opportunity to deliver ground-mounted solar PV.
- **Figure 3.3** presents the number of secondary considerations within the land that is technically suitable for ground-mounted solar PV development that is within an area of greater opportunity to deliver ground-mounted solar PV.
- **Figure 3.4** presents both the number of secondary considerations and opportunities within the land that is technically suitable for ground-mounted solar PV development that is within an area of greater opportunity to deliver ground-mounted solar PV.
- **Figure 3.5** presents the additional opportunities to consider for prioritisation of locations identified as suitable for ground-mounted solar PV.

Figure 3.1: Solar: Phase 1 unconstrained land



- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority
- Solar: Phase 1 unconstrained land

Figure 3.2: Solar: Phase 2 secondary opportunities within Phase 1 unconstrained land



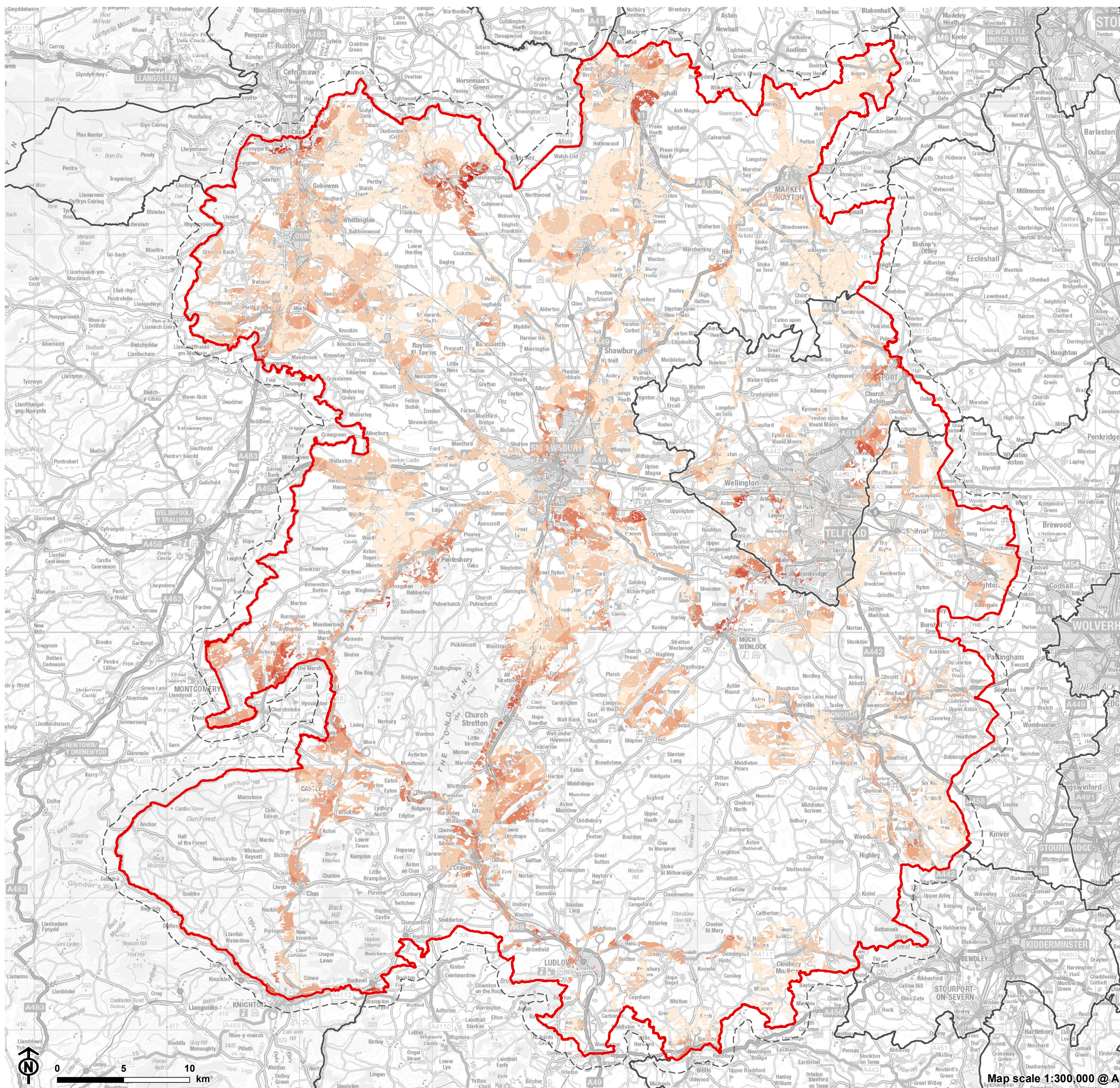
Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. opportunities**

|  |   |
|--|---|
|  | 4 |
|  | 3 |
|  | 2 |
|  | 1 |

Map scale 1:300,000 @ A3

Figure 3.3: Solar: Phase 2 secondary considerations within secondary opportunities

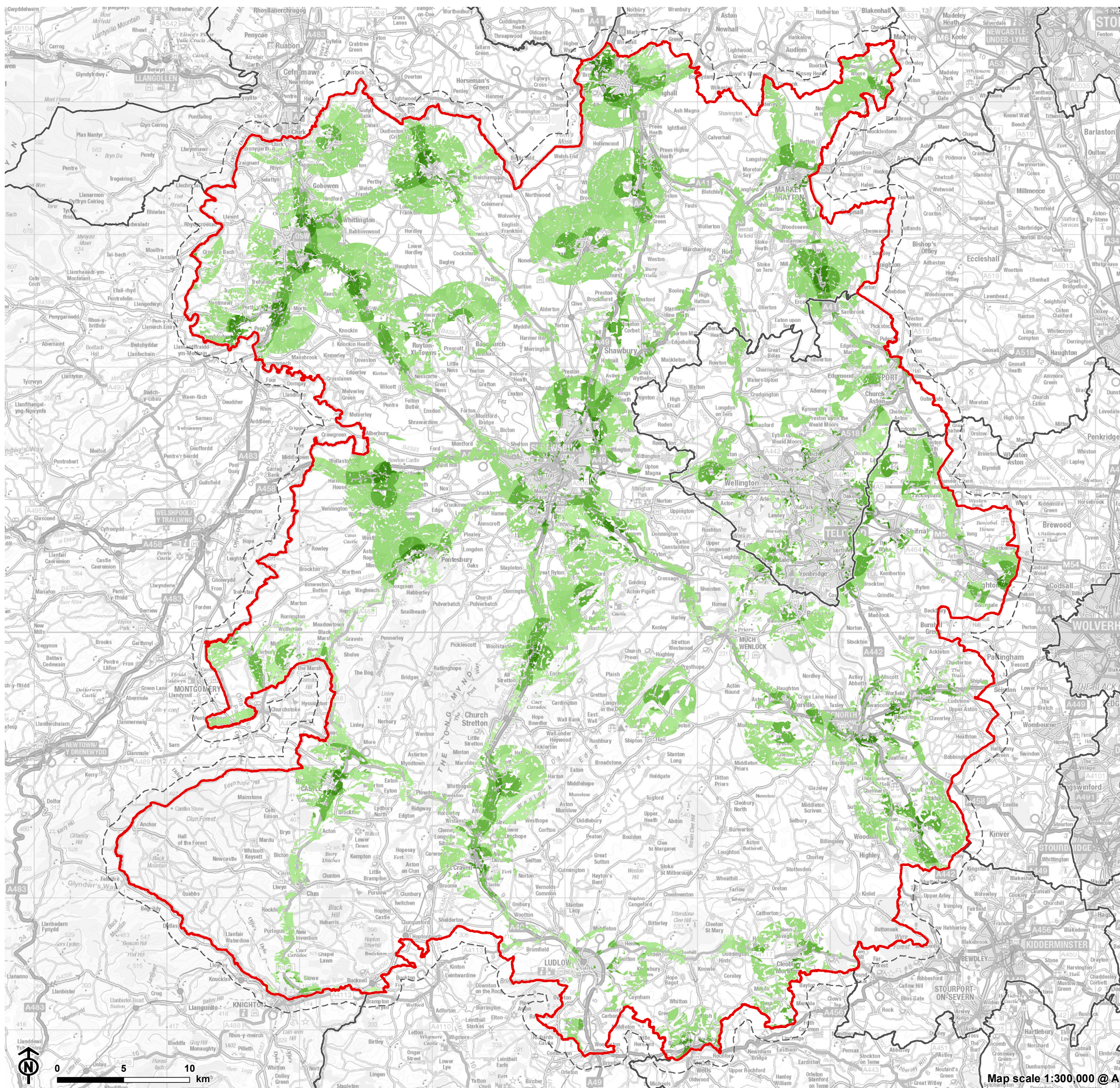


Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. considerations**

|  |   |
|--|---|
|  | 1 |
|  | 2 |
|  | 3 |
|  | 4 |
|  | 5 |
|  | 6 |
|  | 7 |

Figure 3.4: Solar: Phase 2 secondary considerations and secondary opportunities

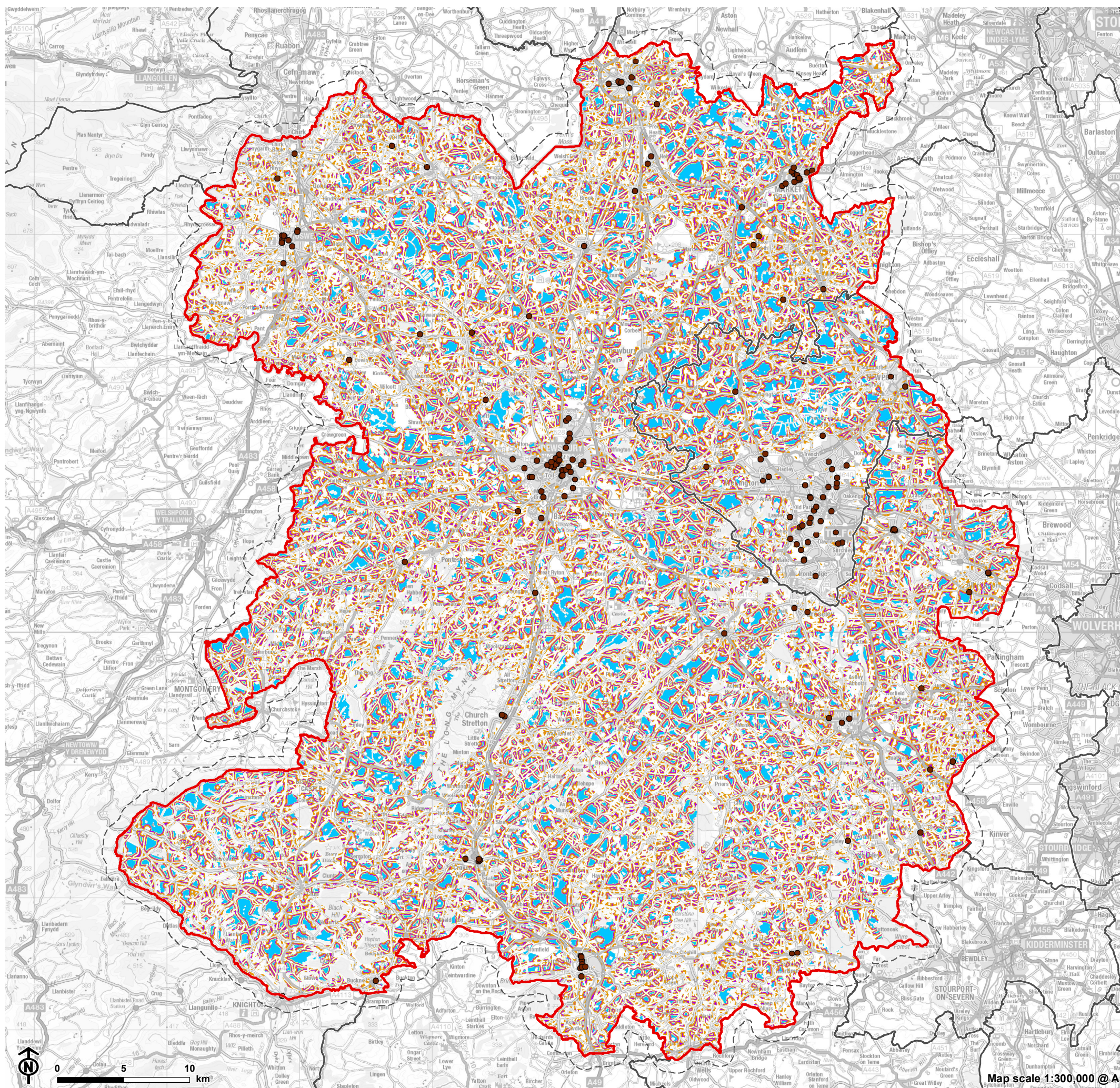


- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority

**No. opportunities, No. considerations**

- 4, 1
- 4, 3
- 4, 2
- 3, 0
- 3, 1
- 3, 2
- 3, 3
- 3, 4
- 3, 5
- 3, 6
- 2, 0
- 2, 1
- 2, 2
- 2, 3
- 2, 4
- 2, 5
- 2, 6
- 2, 7
- 1, 0
- 1, 1
- 1, 2
- 1, 3
- 1, 4
- 1, 5
- 1, 6
- 1, 7

Figure 3.5: Solar: Additional opportunities to consider for prioritisation



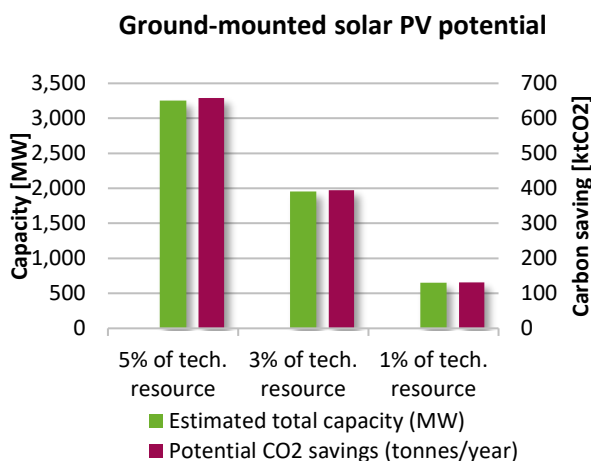
- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority
- Brownfield site
- Very large wind: Phase 1 unconstrained land (for potential co-location)
- Large: Phase 1 unconstrained land (for potential co-location)
- Medium wind: Phase 1 unconstrained land (for potential co-location)
- Small wind: Phase 1 unconstrained land (for potential co-location).

**3.2** Figure 3.6 and Table 3.1 below provide a summary estimate of the technical potential for ground-mounted solar PV within Shropshire. As the full technical potential is very large, utilisation of 1%, 3% and 5% of the resource is also quantified. Adopting the 3% development scale would result in a total potential technical capacity from ground-mounted solar PV across the county of 1,953 MW – this equates to an area of 47 km<sup>2</sup> and a carbon saving of 395 kilotonnes of CO<sub>2</sub> per year.

Table 3.1: Potential ground-mounted solar capacity and output<sup>14</sup>

| Development Scale           | Potential installed capacity (MW) | Electricity output (GWh/year) | Potential CO <sub>2</sub> savings (kilotonnes/yr) |
|-----------------------------|-----------------------------------|-------------------------------|---|
| 100% of technical potential | 65,091                            | 56,449                        | 13,153  |
| 5% of technical potential   | 3,255                             | 2,822                         | 658   |
| 3% technical potential      | 1,953                             | 1,693                         | 395   |
| 1% of technical potential   | 651                               | 564                           | 132   |

Figure 3.6: Ground-mounted solar PV potential.



**3.3** Of the identified land that is technically suitable for ground-mounted solar PV, 662 km<sup>2</sup> is located within an opportunity area, i.e. in proximity to A roads, motorway junctions or electricity substations (see Appendix A). Figure 3.7 and Table 3.2 below provide a summary estimate of the

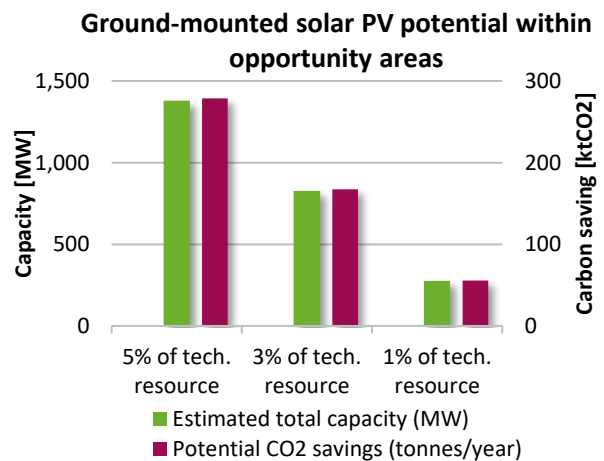
technical potential for ground-mounted solar PV within these opportunity areas.

**3.4** Adopting the 3% development scale would result in a total potential technical capacity from ground-mounted solar PV within these opportunity areas of 827 MW – this equates to an area of 20 km<sup>2</sup> and a carbon saving of 167 kilotonnes of CO<sub>2</sub> per year.

Table 3.2: Potential ground-mounted solar capacity and output within opportunity areas<sup>15</sup>

| Development Scale           | Potential installed capacity (MW) | Electricity output (GWh/year) | Potential CO <sub>2</sub> savings (kilotonnes/yr) |
|-----------------------------|-----------------------------------|-------------------------------|---|
| 100% of technical potential | 27,573                            | 23,912                        | 5,571   |
| 5% of technical potential   | 1,379                             | 1,196                         | 279   |
| 3% technical potential      | 827                               | 717                           | 167   |
| 1% of technical potential   | 276                               | 239                           | 56  |

Figure 3.7: Ground-mounted solar PV potential within opportunity areas



**3.5** An assessment of this nature will necessarily have certain limitations. In addition to those listed in Chapter 2, this includes cumulative impacts, which this high-level assessment

<sup>14</sup> Note that the area of unconstrained land is treated as a single block of land. This is not the case in reality.

<sup>15</sup> Note that the area of unconstrained land is treated as a single block of land. This is not the case in reality.

cannot take into account, but which would affect consideration of planning applications in practice.

**3.6** Ground-mounted solar development is less constrained relative to wind development, in terms of the factors that can reasonably be considered within a high-level resource assessment. As such, a large area of land has been identified as technically suitable for ground-mounted solar development. However, in practice development of all or even the majority of this land for ground-mounted solar would clearly not be appropriate.

**3.7** Other considerations that would also reduce the deployable potential of ground-mounted solar PV in practice include landscape sensitivity, grid connection and development income. These factors would also need to be considered when determining the suitability of a site for development.

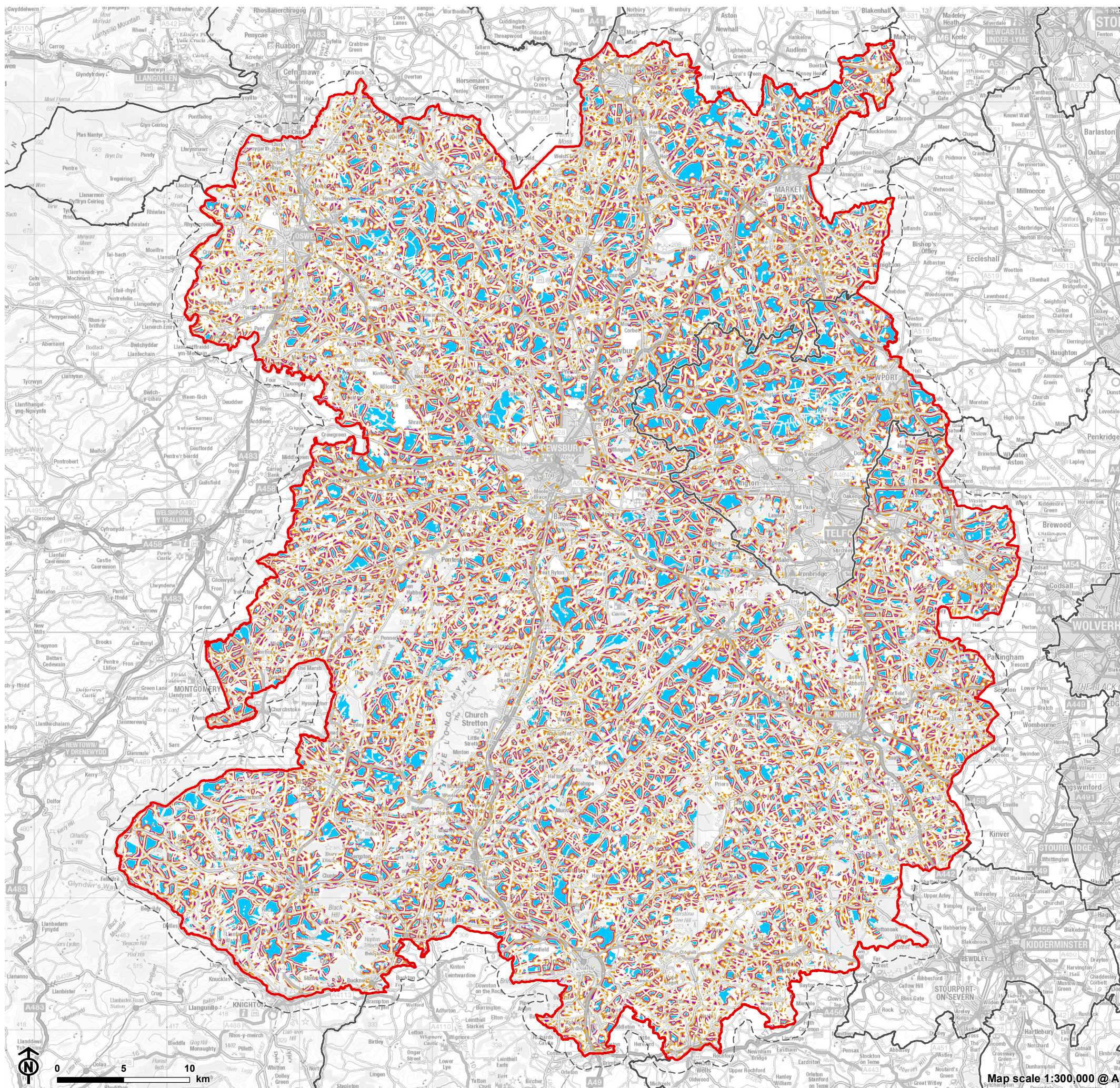
## Wind potential

**3.8** Following application of the method outlined in **Chapter 2**, the following maps were produced:

- **Figure 3.8** presents all land that is technically suitable for wind development.
- **Figure 3.9** presents all land that is technically suitable for small wind turbine development.
- **Figure 3.10** presents the number of secondary opportunities within the land that is technically suitable for small wind turbine development that is within an area of greater opportunity to deliver small wind turbine.
- **Figure 3.11** presents the number of secondary considerations within the land that is technically suitable for small wind turbine development that is within an area of greater opportunity to deliver small wind turbine.
- **Figure 3.12** presents both the number of secondary considerations and opportunities within the land that is technically suitable for small wind turbine development that is within an area of greater opportunity to deliver small wind turbine.
- **Figure 3.13** to **Figure 3.24** present the above four figures for medium, large and very large turbines.
- **Figure 3.25** presents the additional opportunities to consider for prioritisation of locations identified as suitable for wind turbine development.
- **Figure 3.26** to **Figure 3.29** present wind speeds as different heights, with areas of higher wind speeds at each height providing greater generation potential for each scale of wind turbine. The 50m height wind speed data is particularly relevant for small and medium scale turbines, the 100m height data for medium and large

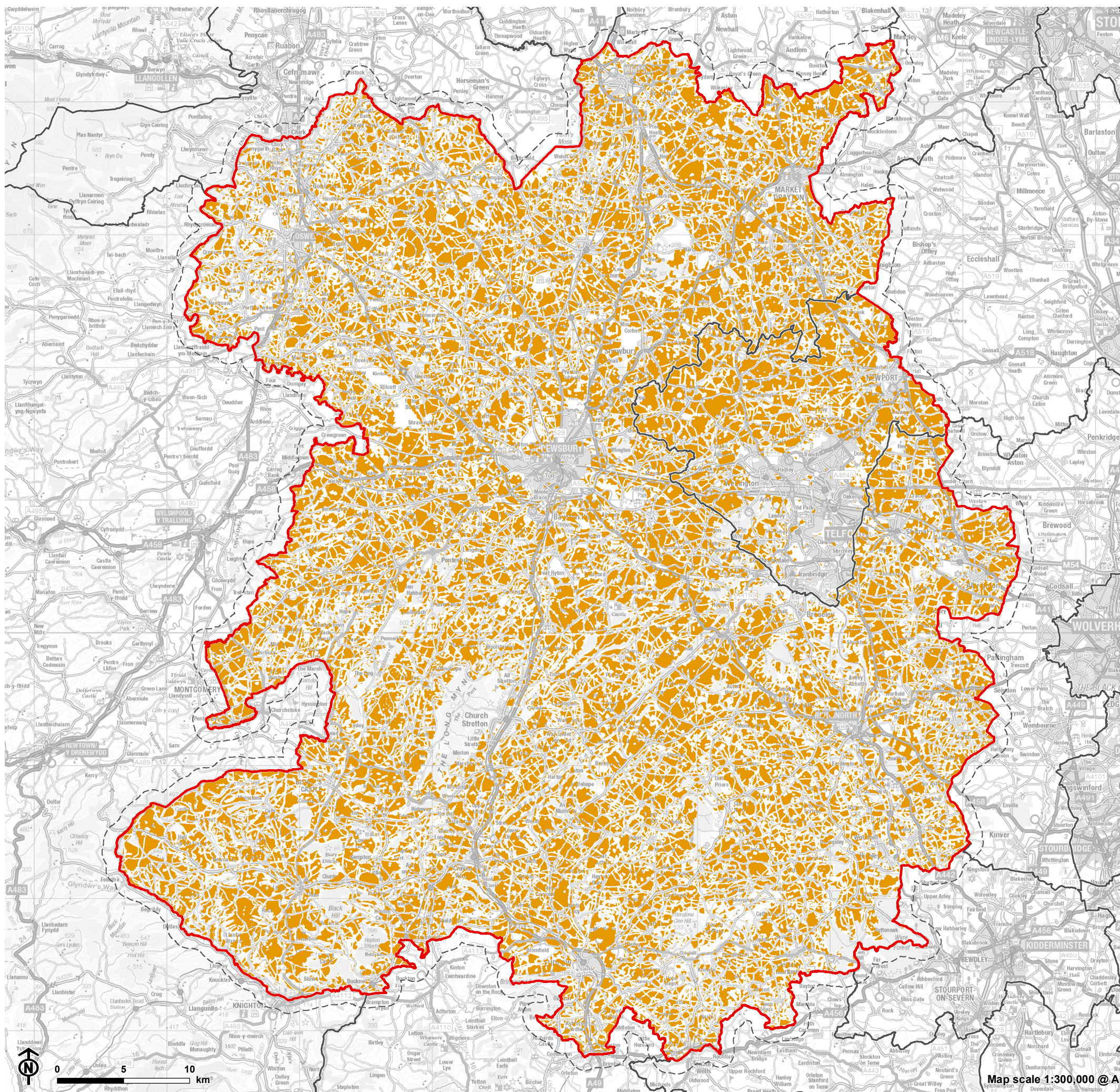
scale turbines, the 150m data for large and very large scale turbines, and the 200m data for very large scale turbines.

Figure 3.8: Wind: Phase 1 unconstrained land – All scales



- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority
- Very large wind: Phase 1 unconstrained land
- Large: Phase 1 unconstrained land
- Medium wind: Phase 1 unconstrained land
- Small wind: Phase 1 unconstrained land

Figure 3.9: Wind: Phase 1 unconstrained land – Small scale







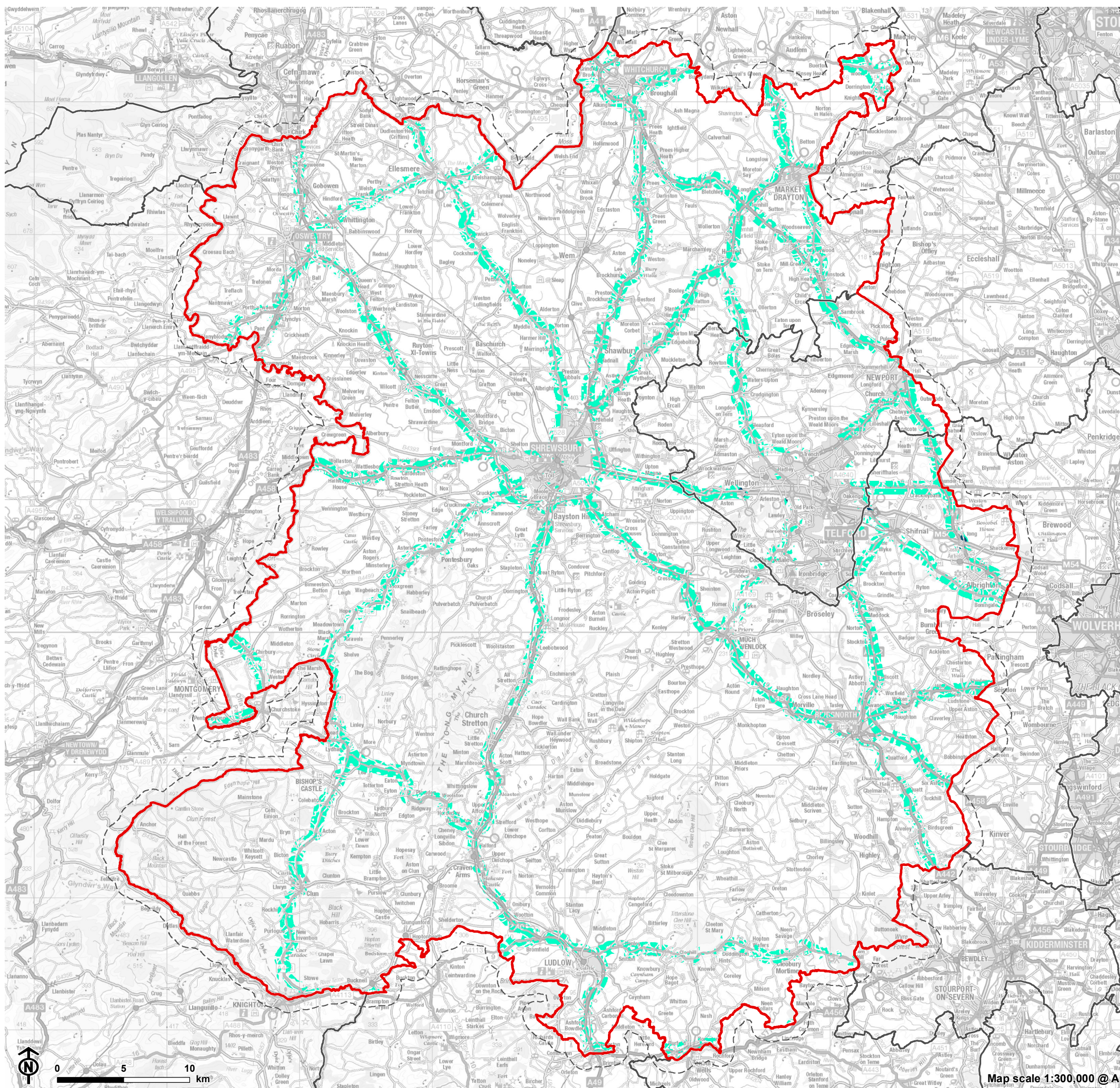
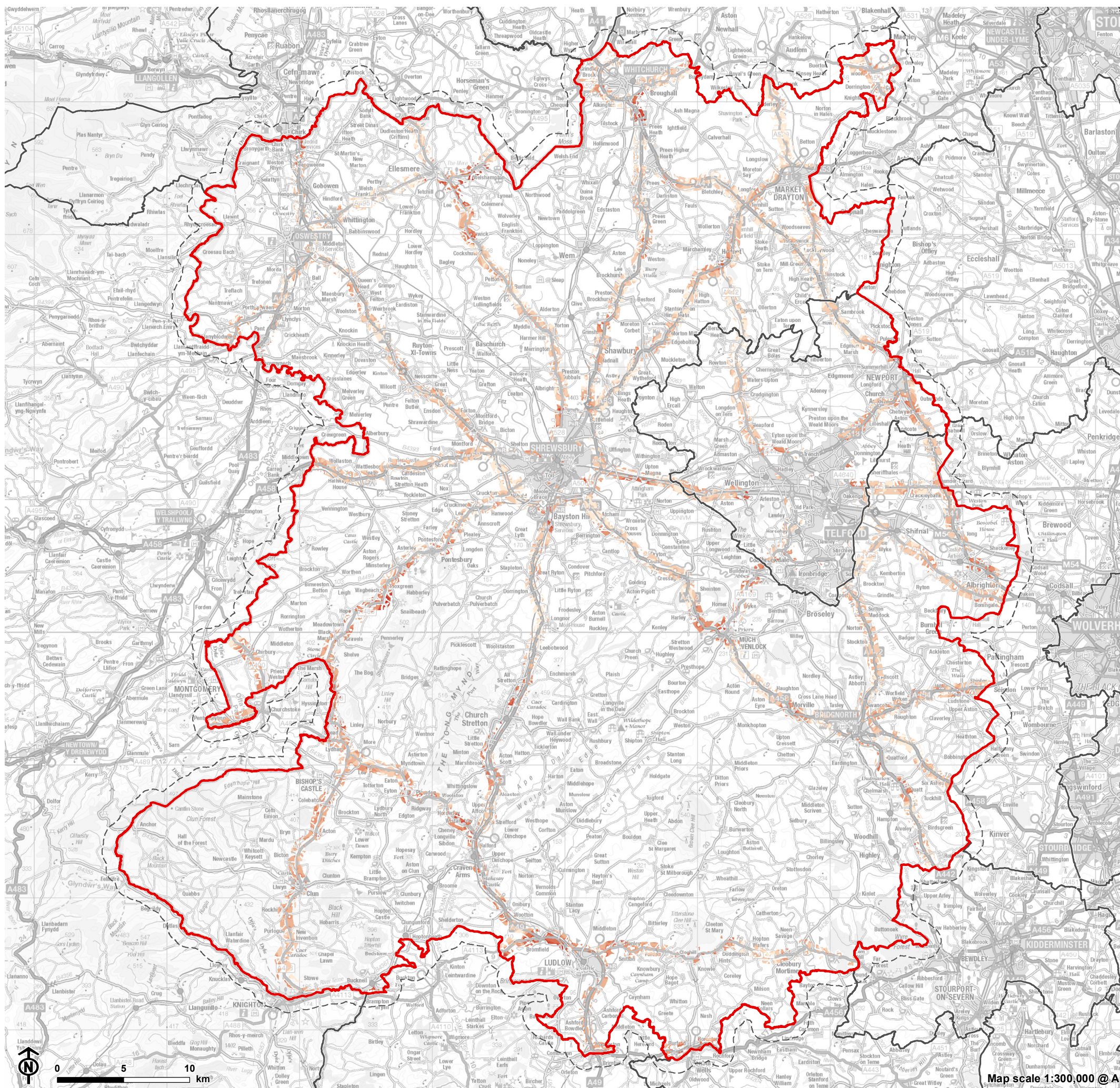
-  Shropshire
-  Shropshire 1km Buffer
-  Neighbouring Local Authority
-  Small wind: Phase 1 unconstrained land

Figure 3.10: Wind: Phase 2 secondary opportunities within Phase 1 unconstrained land – Small scale



- Shropshire
  - Shropshire 1km Buffer
  - Neighbouring Local Authority
- No. opportunities**
- 2
  - 1

Figure 3.11: Wind: Phase 2 secondary considerations within secondary opportunities – Small scale

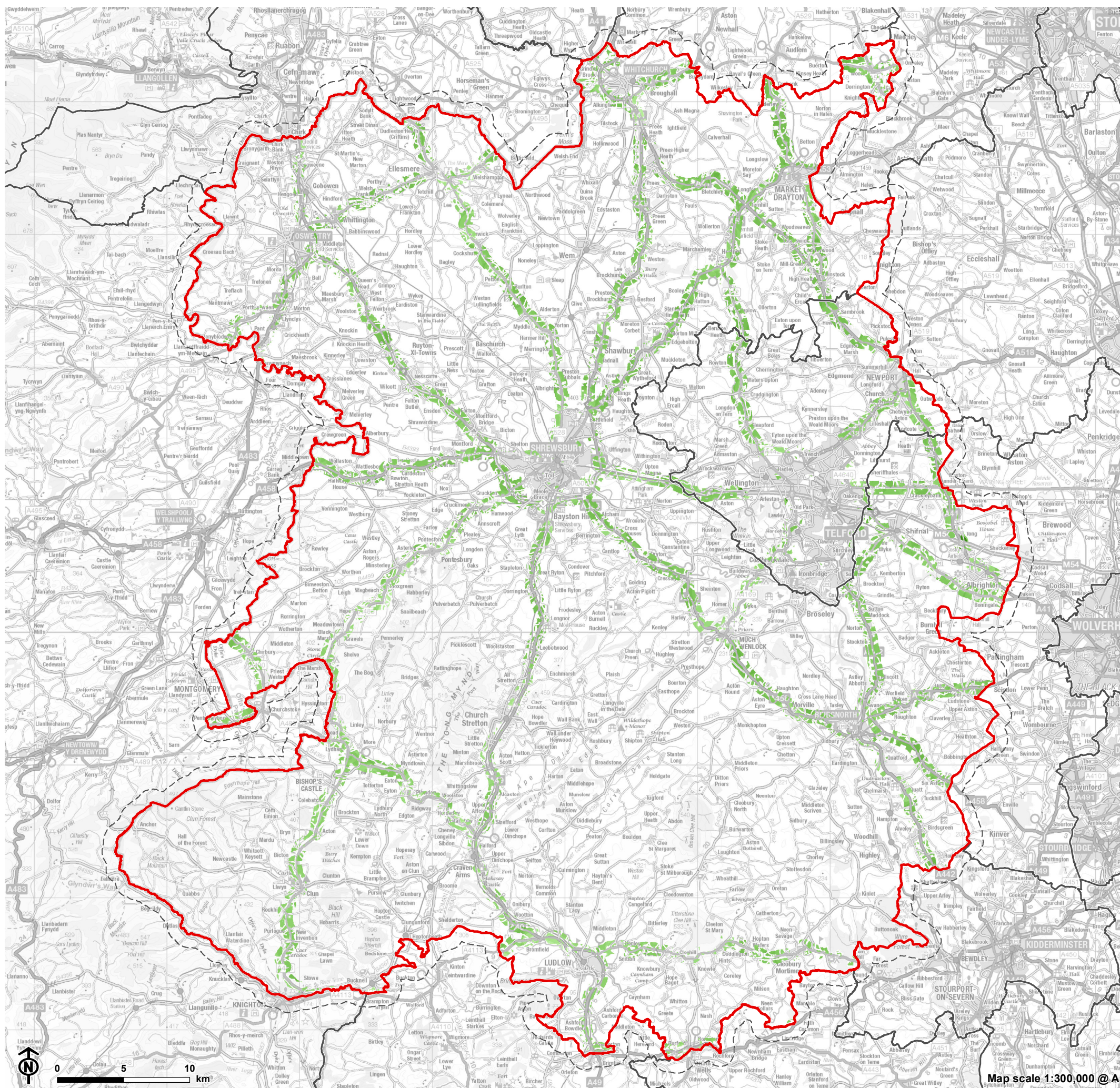


Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. considerations**

|  |   |
|--|---|
|  | 1 |
|  | 2 |
|  | 3 |
|  | 4 |
|  | 5 |
|  | 6 |
|  | 7 |
|  | 8 |

Figure 3.12: Wind: Phase 2 secondary considerations and secondary opportunities – Small scale

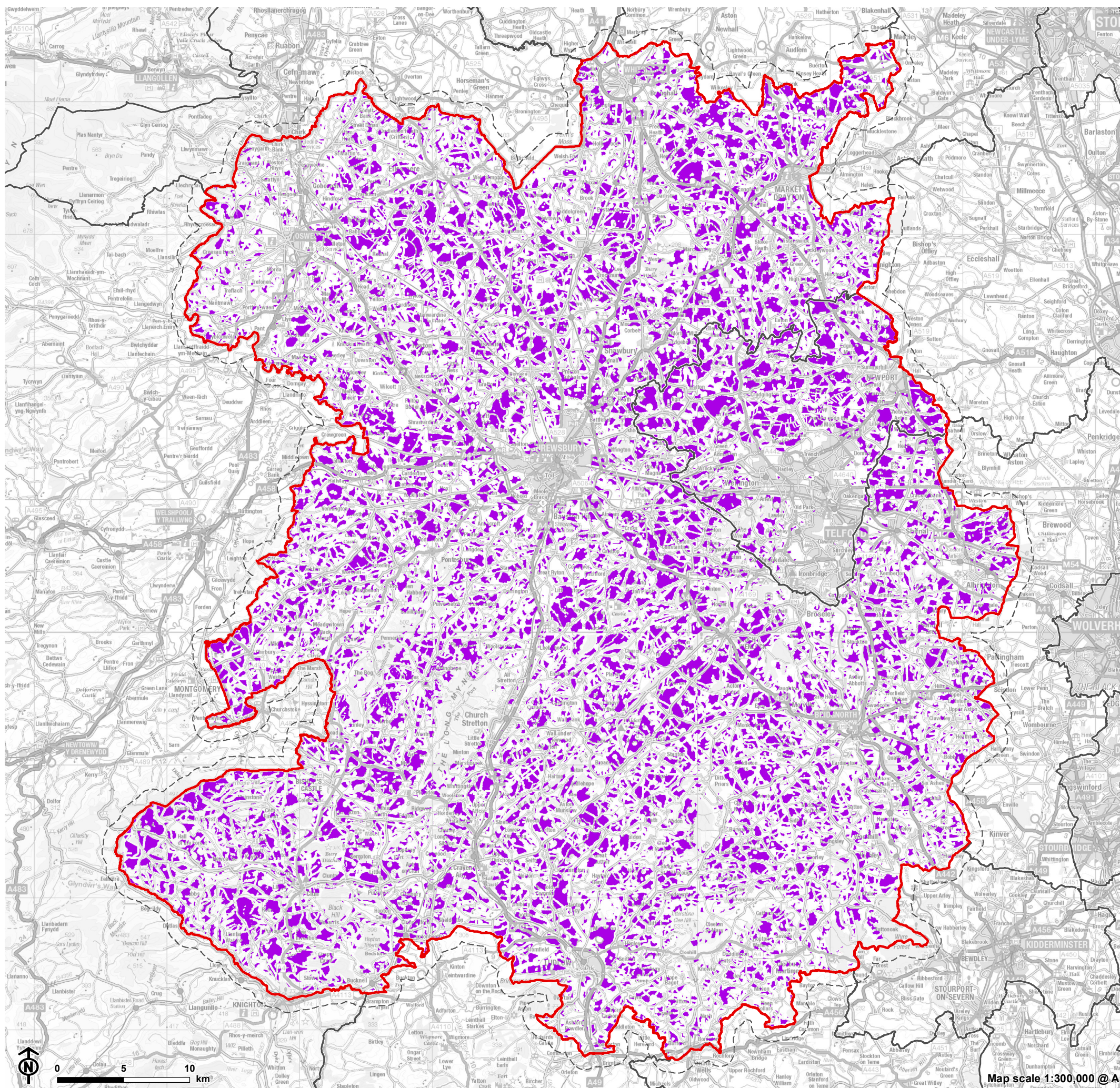


- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority

**No. opportunities, No. considerations**

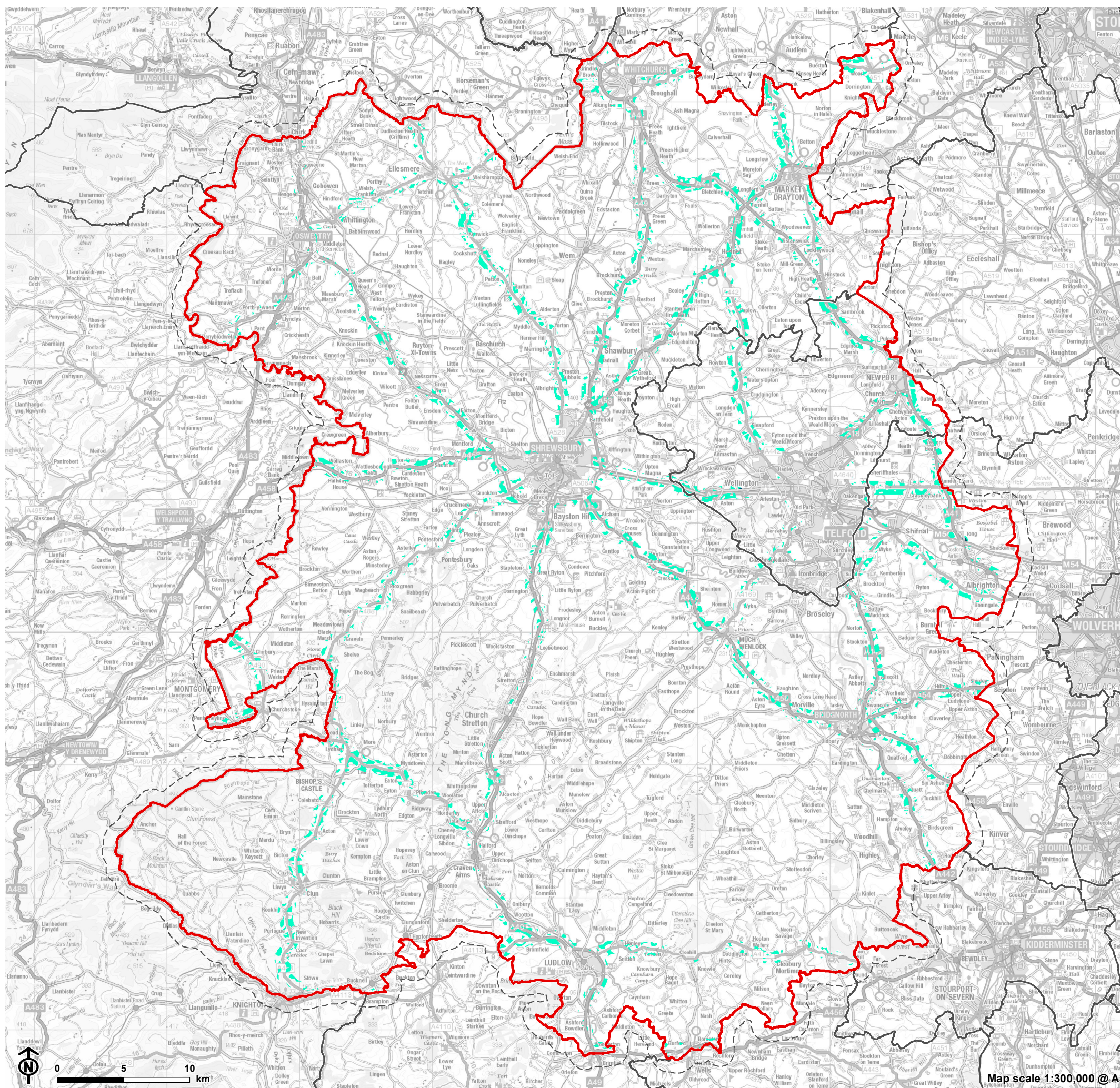
- 2, 0
- 2, 1
- 2, 2
- 2, 3
- 2, 4
- 2, 5
- 2, 6
- 2, 7
- 1, 0
- 1, 1
- 1, 2
- 1, 3
- 1, 4
- 1, 5
- 1, 6
- 1, 7
- 1, 8

Figure 3.13: Wind: Phase 1 unconstrained land – Medium scale



- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority
- Medium wind: Phase 1 unconstrained land

Figure 3.14: Wind: Phase 2 secondary opportunities within Phase 1 unconstrained land – Medium scale



Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. opportunities**

2  
 1



Map scale 1:300,000 @ A3

Figure 3.15: Wind: Phase 2 secondary considerations within secondary opportunities – Medium scale

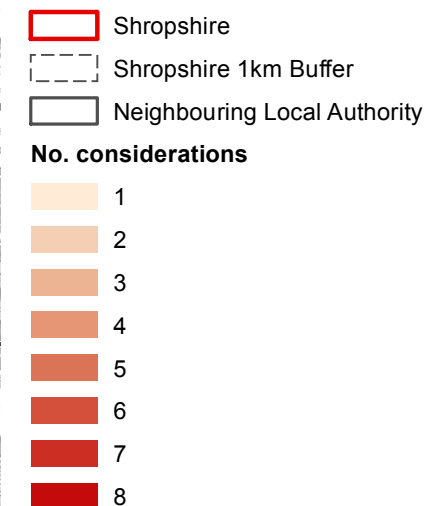
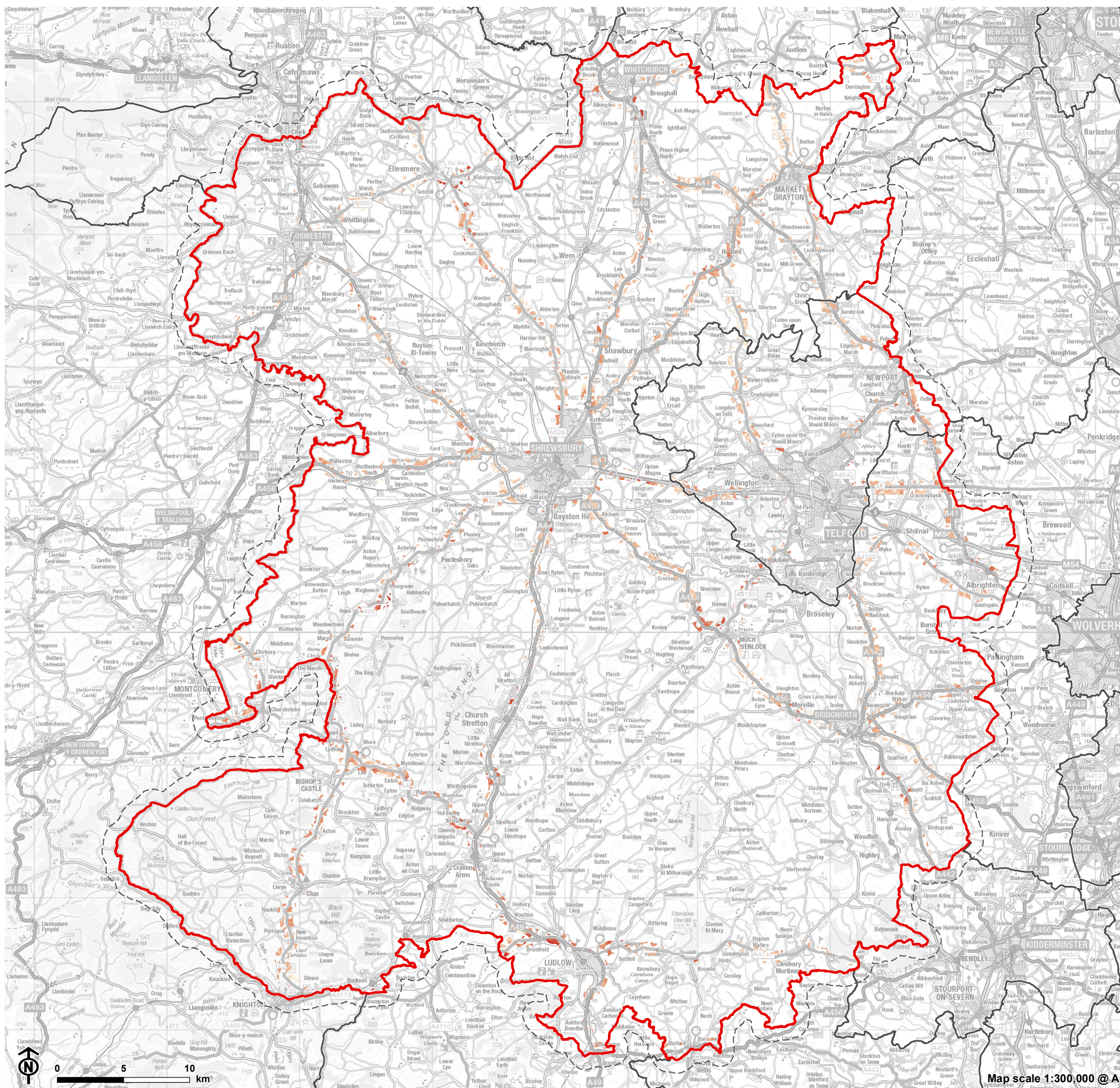
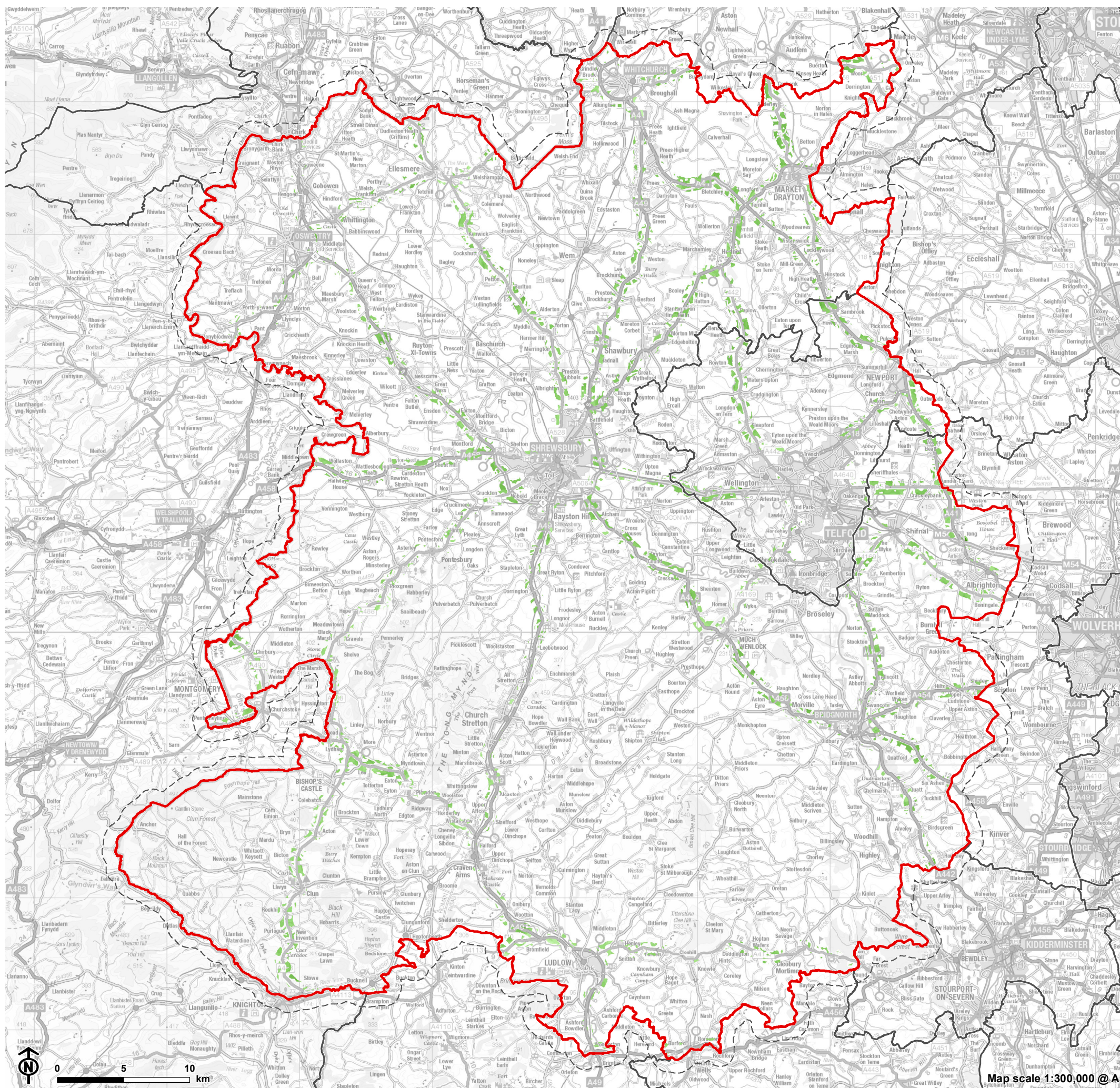


Figure 3.16: Wind: Phase 2 secondary considerations and secondary opportunities – Medium scale

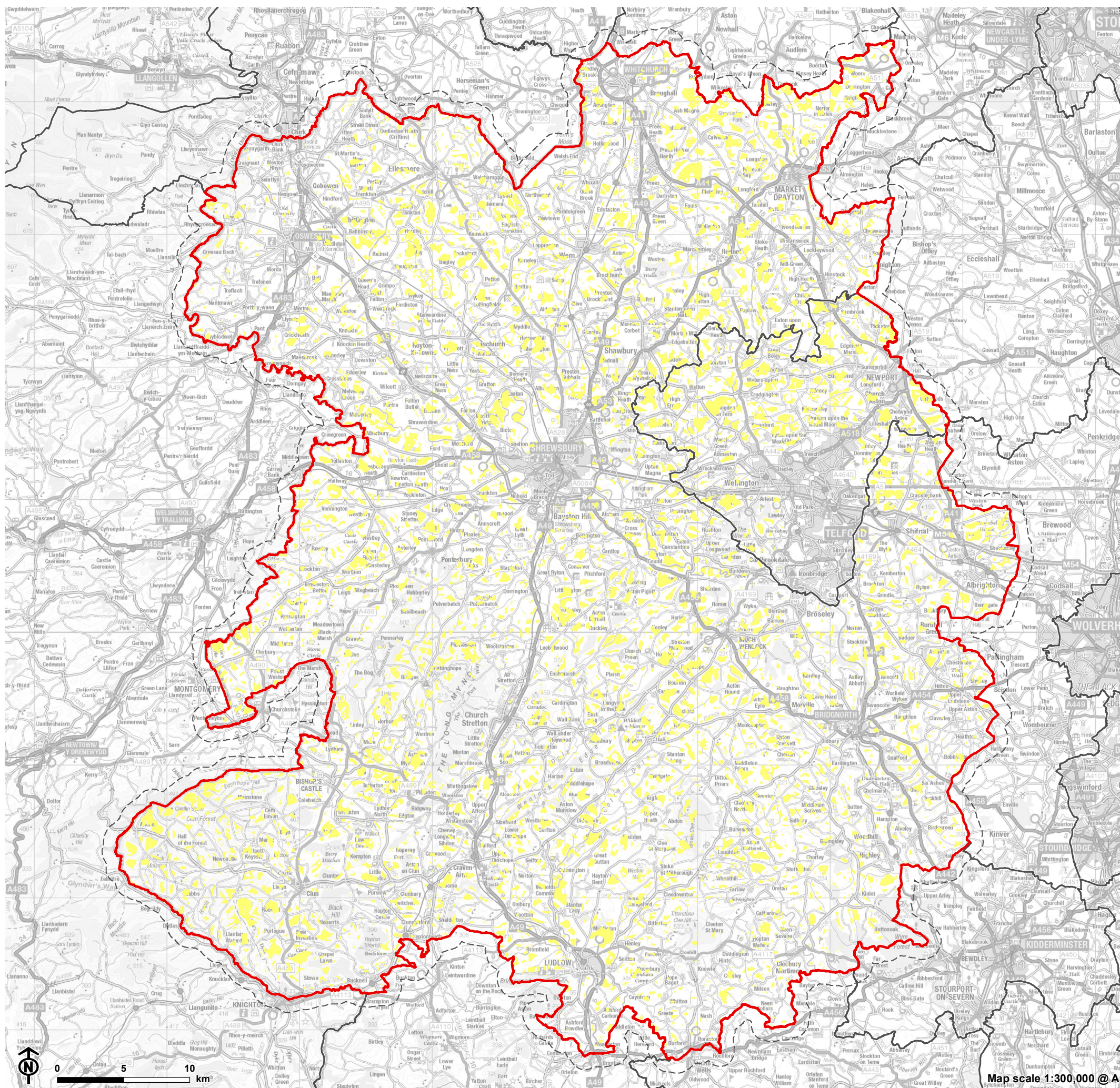


Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. opportunities, No. considerations**

|  |      |
|--|------|
|  | 2, 1 |
|  | 2, 2 |
|  | 2, 3 |
|  | 2, 4 |
|  | 1, 0 |
|  | 1, 1 |
|  | 1, 2 |
|  | 1, 3 |
|  | 1, 4 |
|  | 1, 5 |
|  | 1, 6 |
|  | 1, 7 |
|  | 1, 8 |

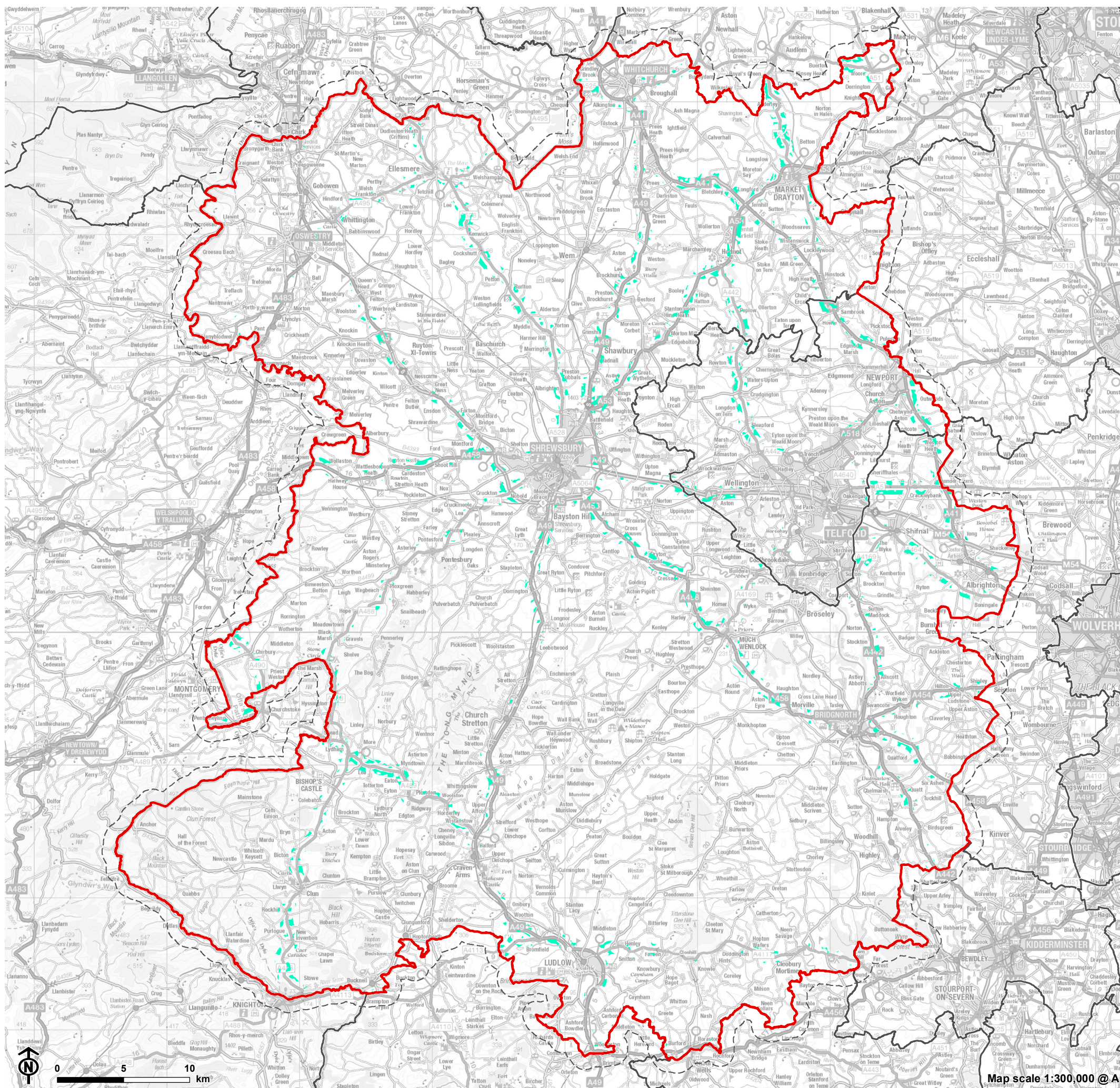
Figure 3.17: Wind: Phase 1 unconstrained land – Large scale



- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority
- Large wind: Phase 1 unconstrained land

Map scale 1:300,000 @ A3

Figure 3.18: Wind: Phase 2 secondary opportunities within Phase 1 unconstrained land – Large scale

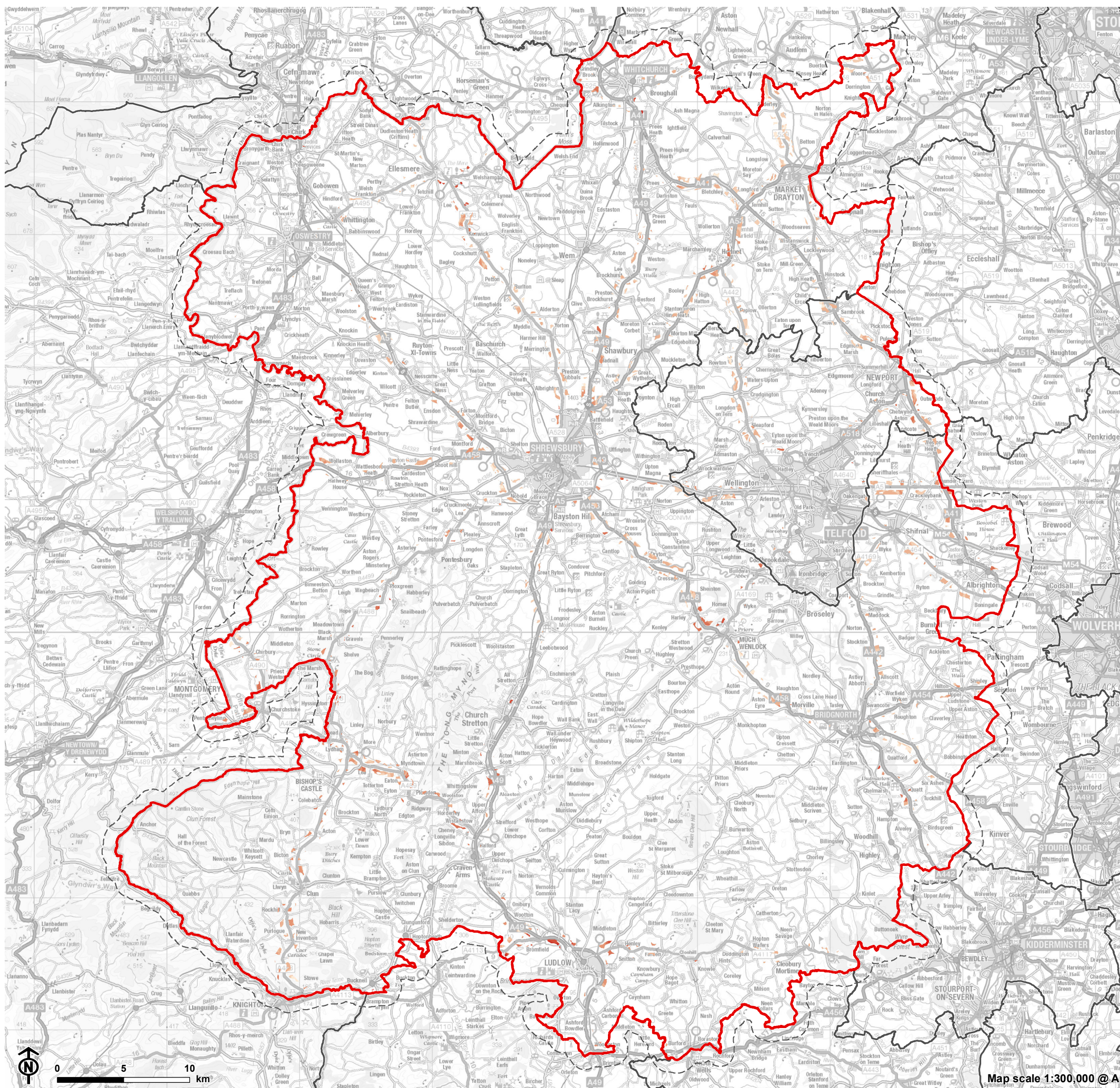


Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. opportunities**

2  
 1

Figure 3.19: Wind: Phase 2 secondary considerations within secondary opportunities – Large scale

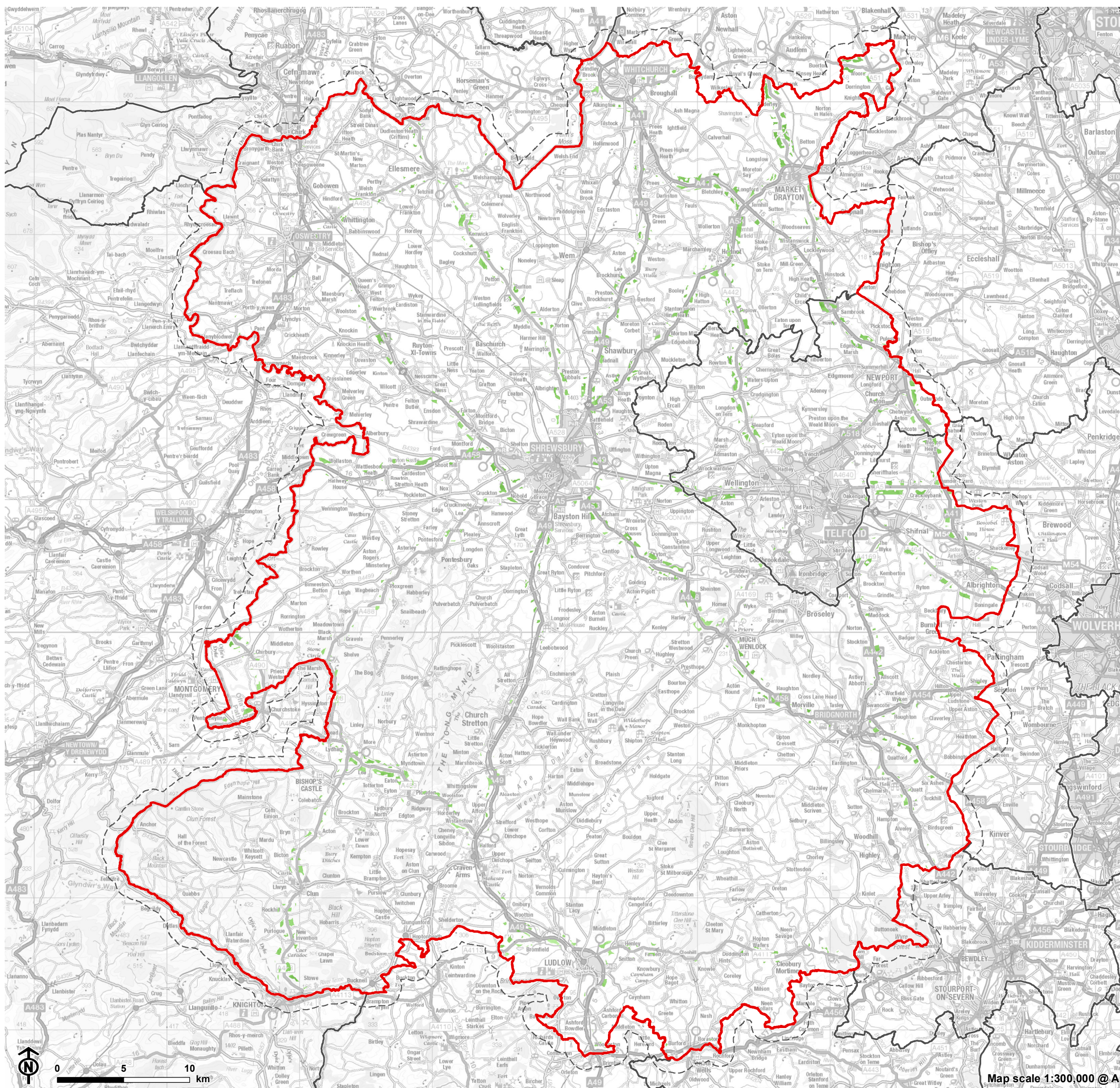


Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. considerations**

|  |   |
|--|---|
|  | 1 |
|  | 2 |
|  | 3 |
|  | 4 |
|  | 5 |
|  | 6 |
|  | 7 |

Figure 3.20: Wind: Phase 2 secondary considerations and secondary opportunities – Large scale

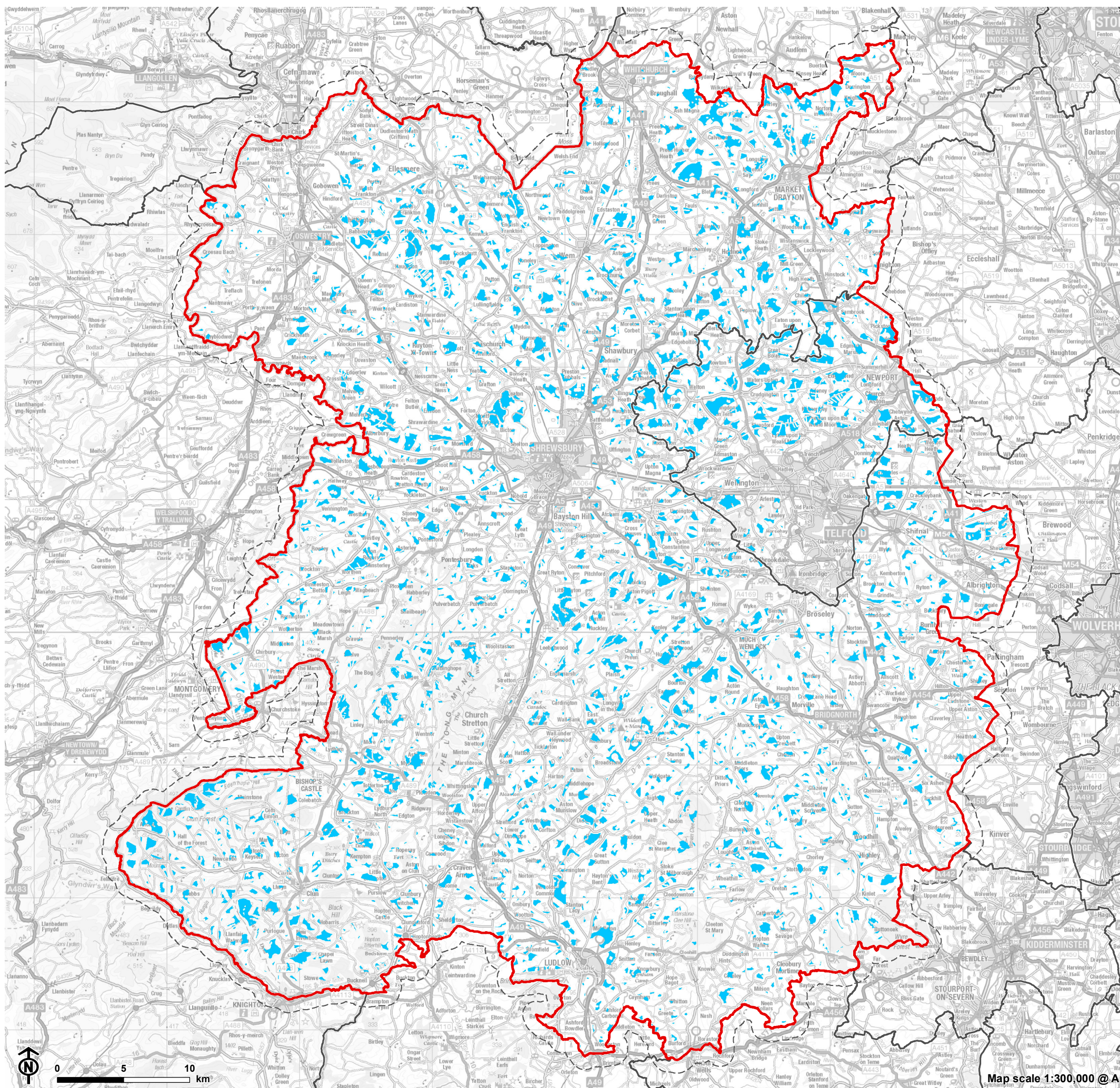


Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. opportunities, No. considerations**

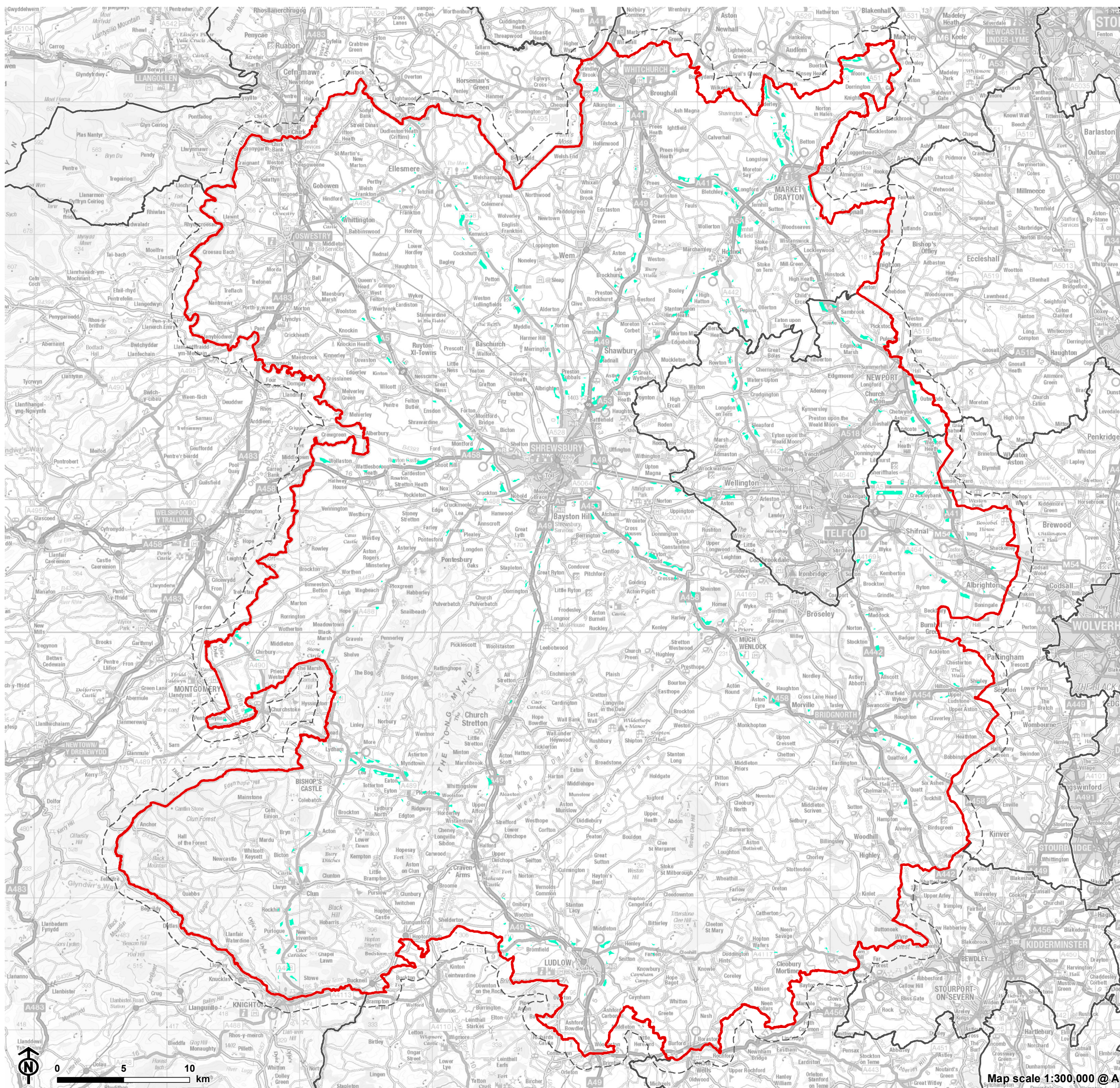
|  |      |
|--|------|
|  | 2, 4 |
|  | 1, 0 |
|  | 1, 1 |
|  | 1, 2 |
|  | 1, 3 |
|  | 1, 4 |
|  | 1, 5 |
|  | 1, 6 |
|  | 1, 7 |

Figure 3.21: Wind: Phase 1 unconstrained land – Very large scale



- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority
- Very large wind: Phase 1 unconstrained land

Figure 3.22: Wind: Phase 2 secondary opportunities within Phase 1 unconstrained land – Very large scale

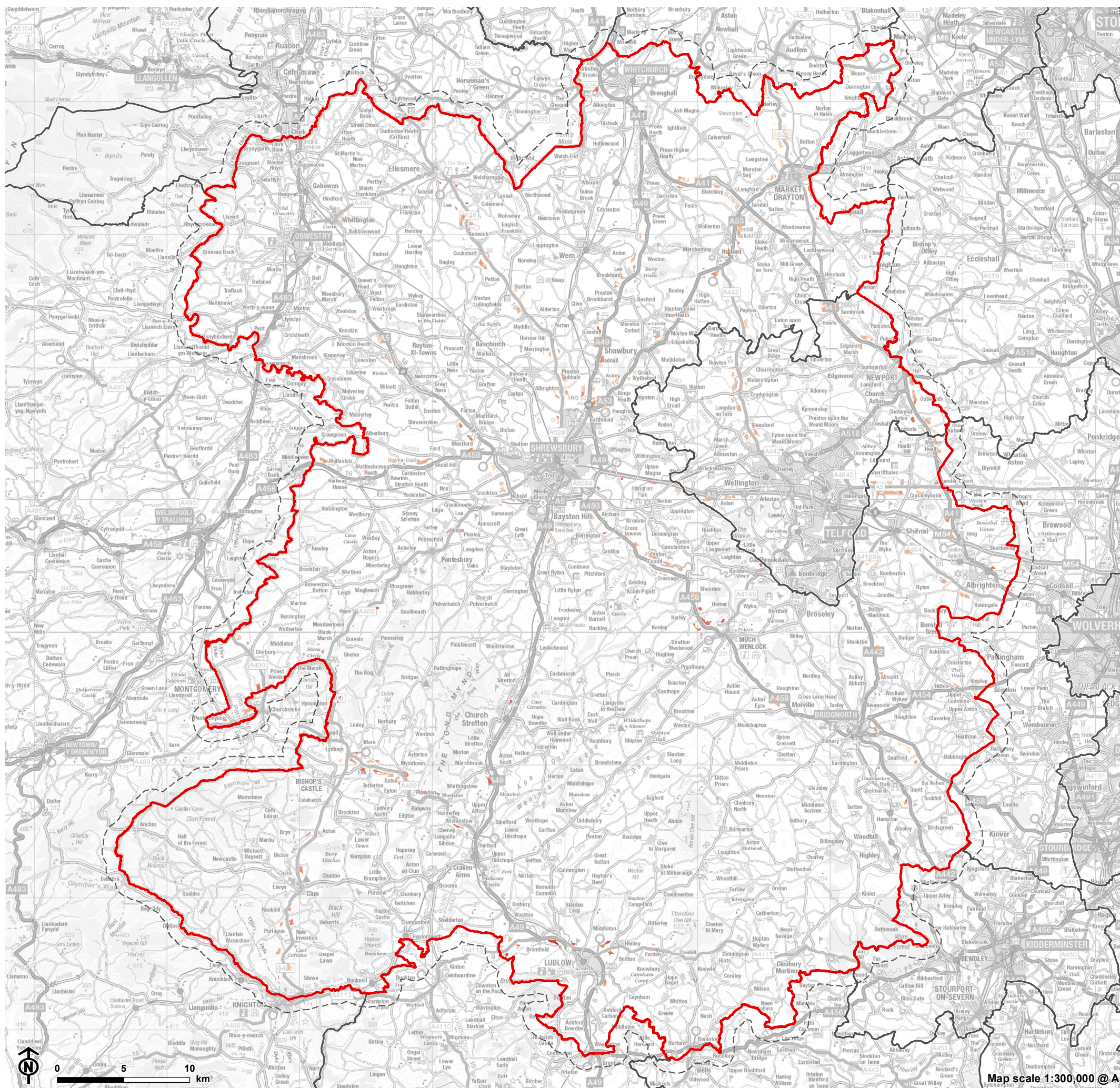


Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. opportunities**

2  
 1

Figure 3.23: Wind: Phase 2 secondary considerations within secondary opportunities – Very large scale



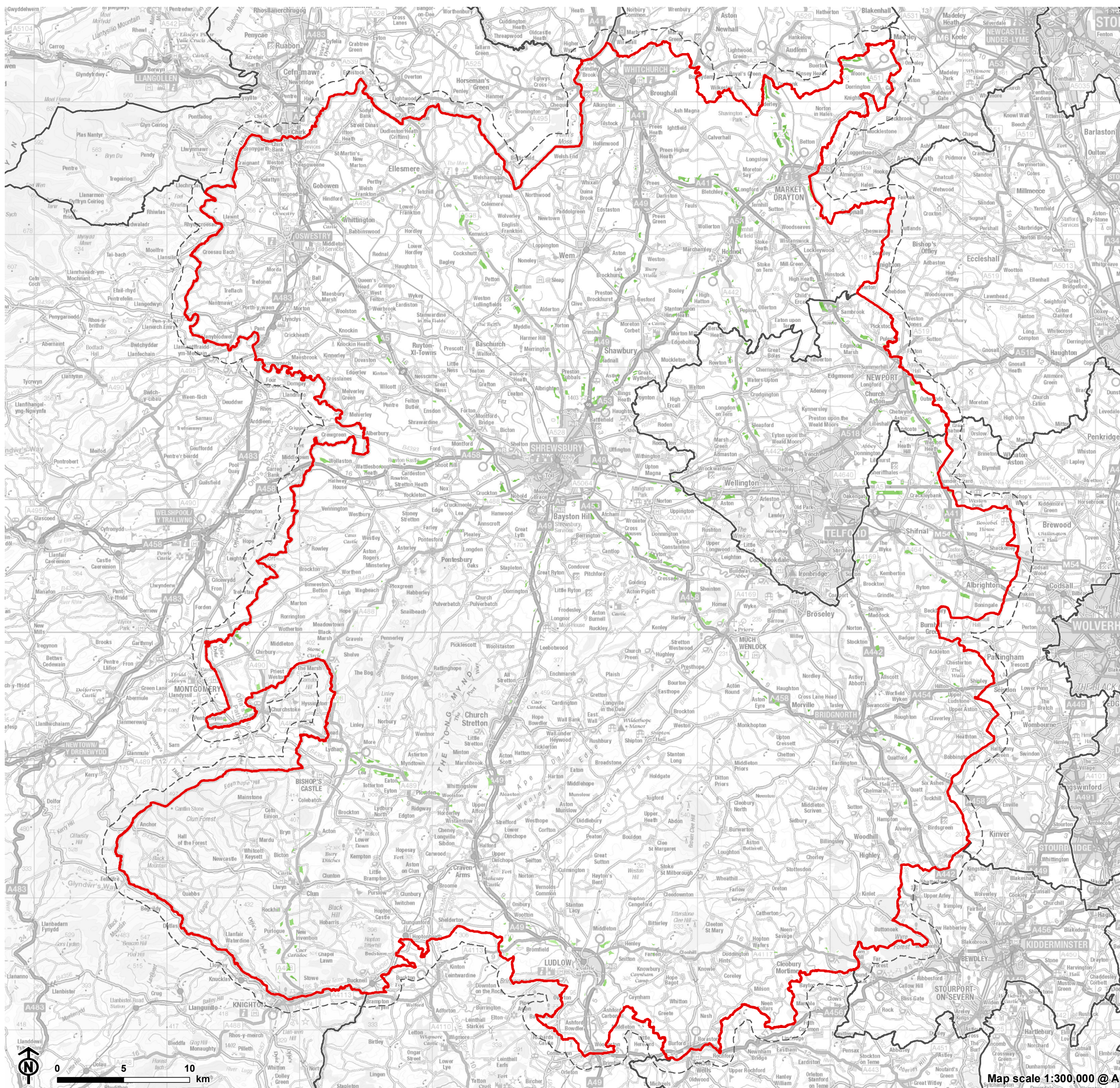
**Legend**

- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority

**No. considerations**

- 1
- 2
- 3
- 4
- 5
- 6
- 7

Figure 3.24: Wind: Phase 2 secondary considerations and secondary opportunities – Very large scale

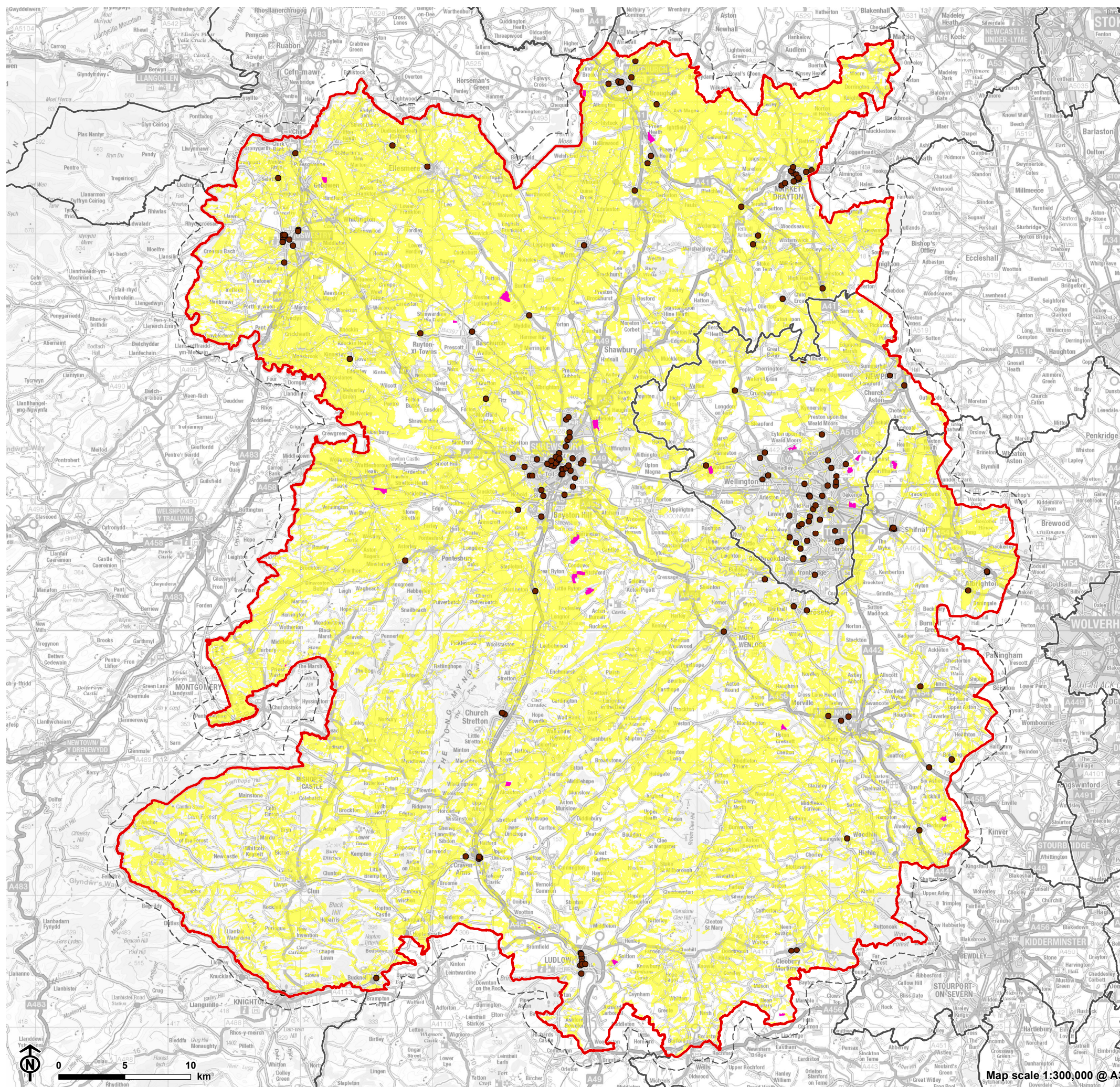


Shropshire  
 Shropshire 1km Buffer  
 Neighbouring Local Authority

**No. opportunities, No. considerations**

|  |      |
|--|------|
|  | 2, 4 |
|  | 1, 0 |
|  | 1, 1 |
|  | 1, 2 |
|  | 1, 3 |
|  | 1, 4 |
|  | 1, 5 |
|  | 1, 6 |
|  | 1, 7 |

Figure 3.25: Wind: Additional opportunities to consider for prioritisation – Brownfield land, existing solar sites and Solar: Phase 1 unconstrained land

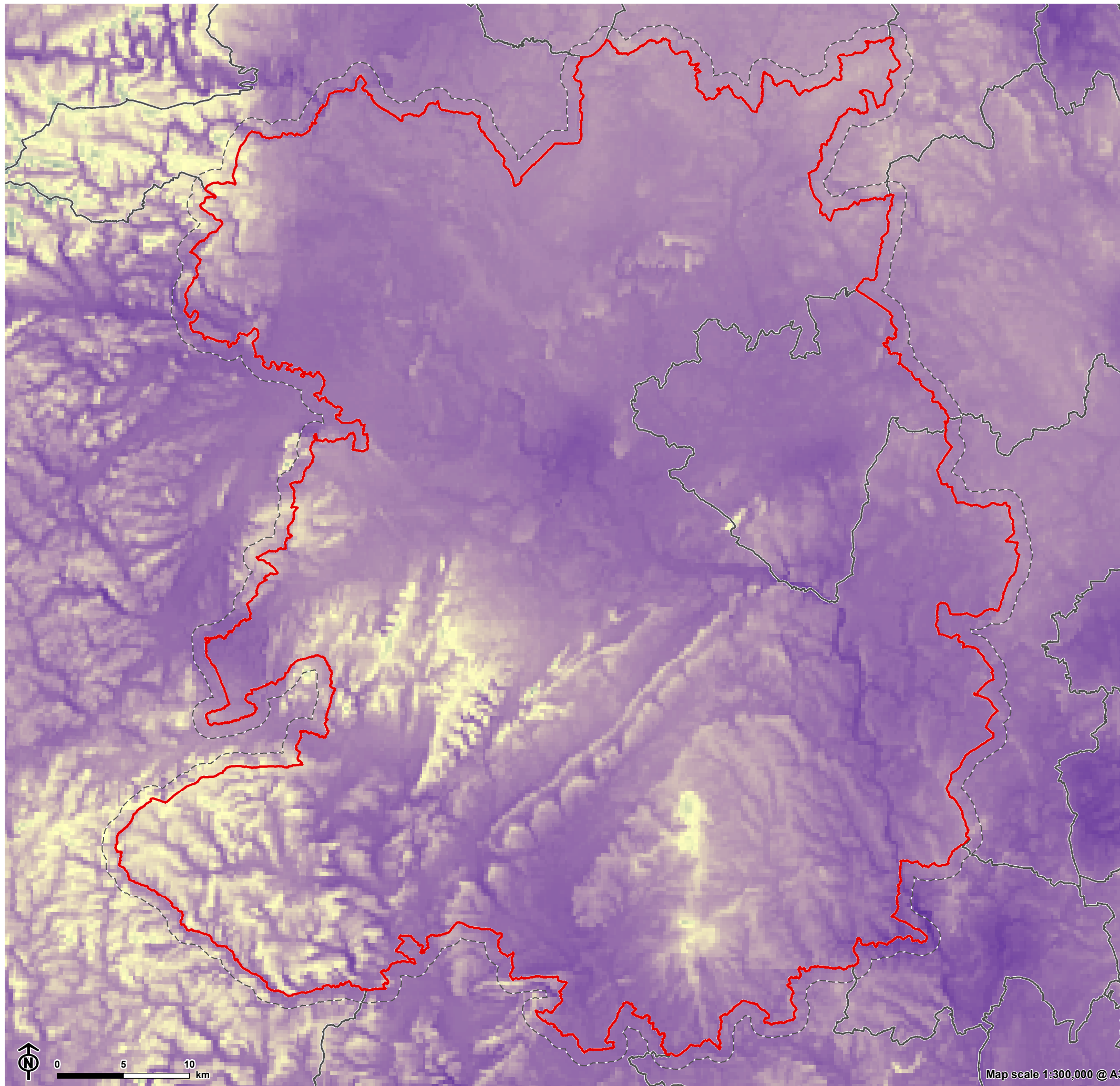


- Shropshire
- Shropshire 1km Buffer
- Neighbouring Local Authority
- Brownfield site
- Existing solar (for potential co-location)
- Solar: Phase 1 unconstrained land (for potential co-location).



Map scale 1:300,000 @ A3

Figure 3.26: Wind: Additional opportunities to consider for prioritisation – Windspeeds at 50m height (small and medium scale turbines)

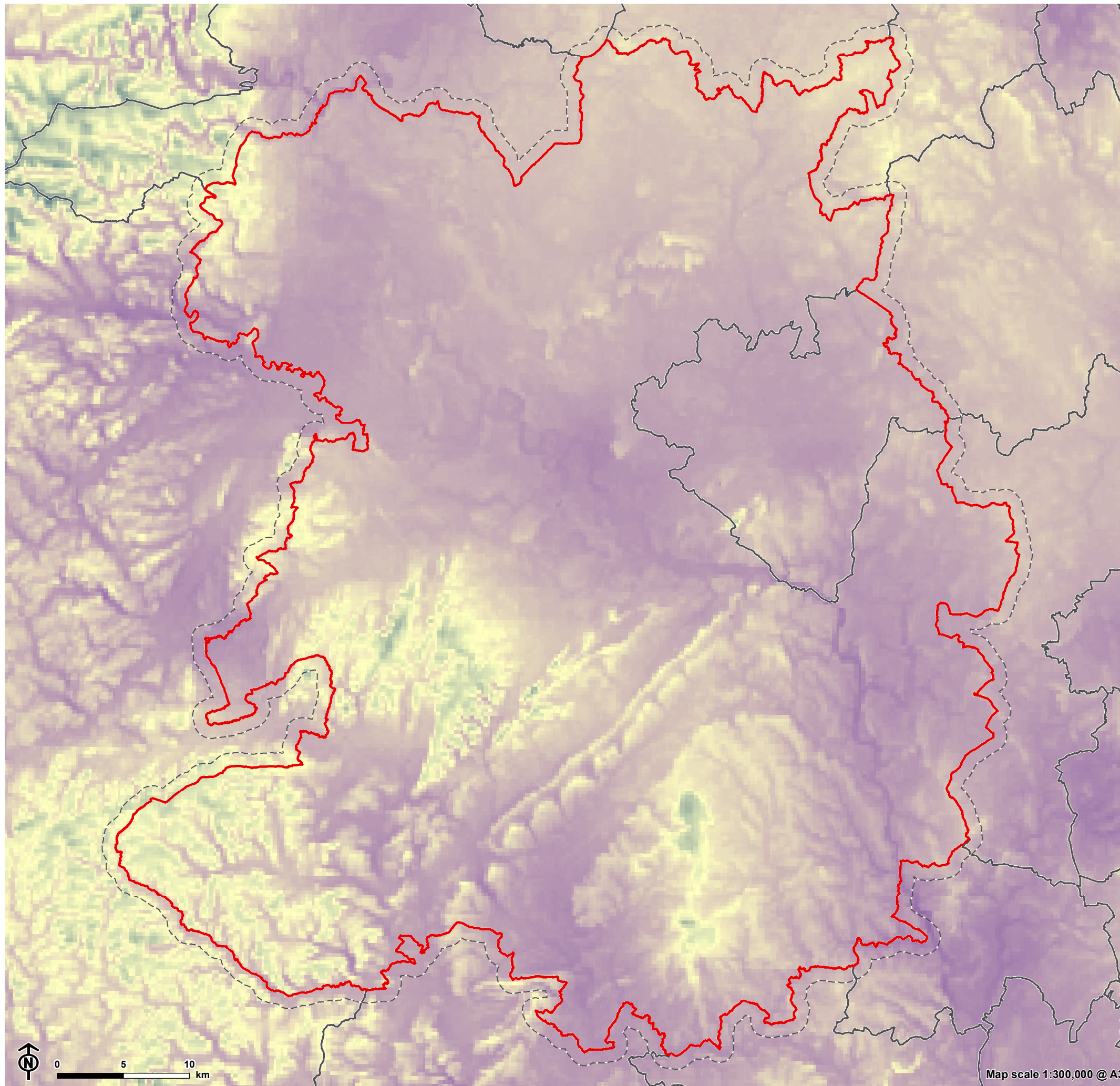


- Shropshire
  - Shropshire 1km Buffer
  - Neighbouring Local Authority
- Wind speed (m/s)**
- High : 15
  - Low : 4



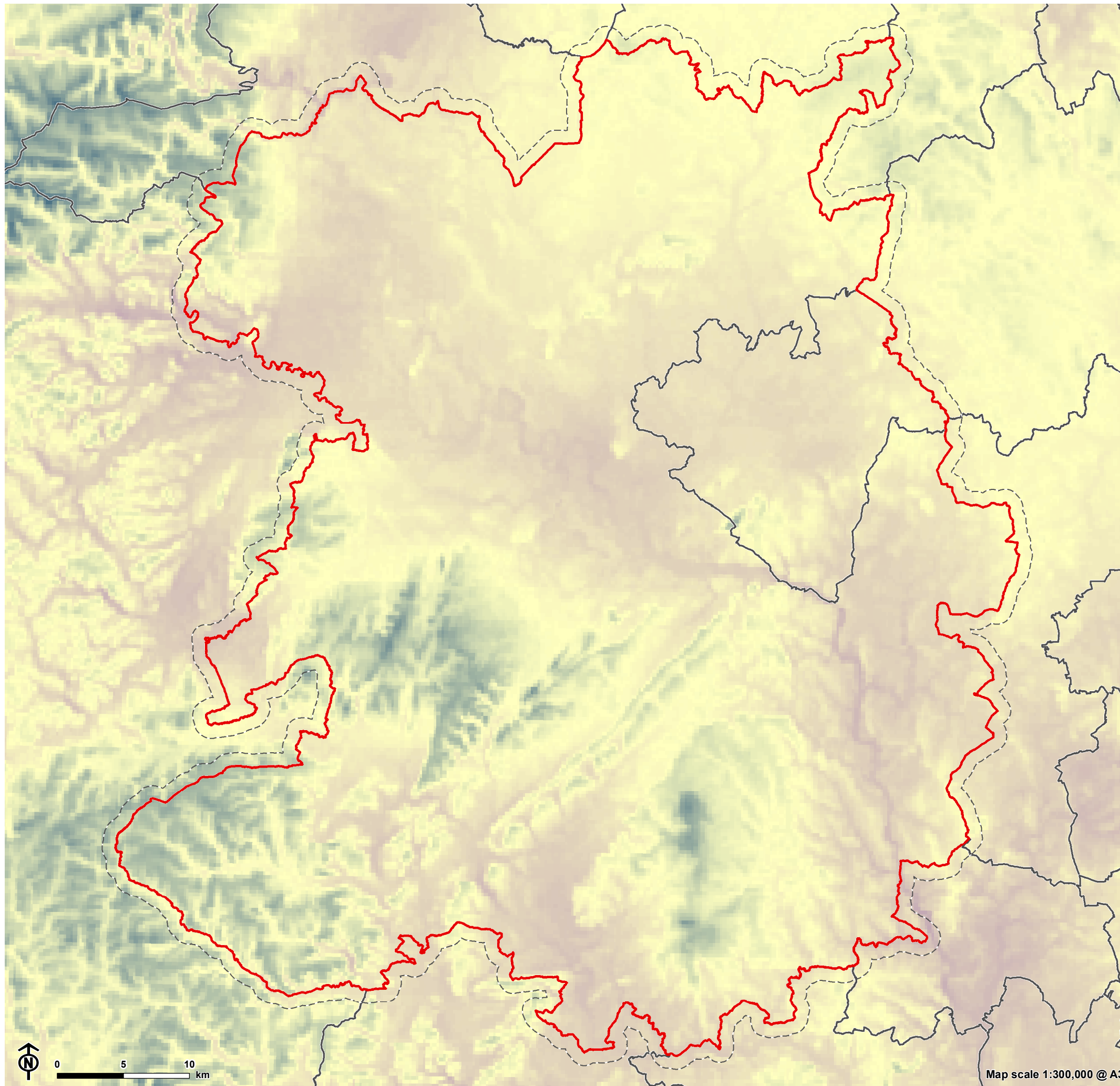
Map scale 1:300,000 @ A3

Figure 3.27: Wind: Additional opportunities to consider for prioritisation – Windspeeds at 100m height (medium and large scale turbines)

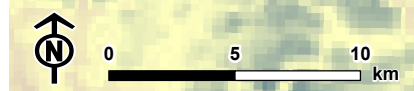


- Shropshire
  - Shropshire 1km Buffer
  - Neighbouring Local Authority
- Wind speed (m/s)**
- High : 15
  - Low : 4

Figure 3.28: Wind: Additional opportunities to consider for prioritisation – Windspeeds at 150m height (large and very large scale turbines)

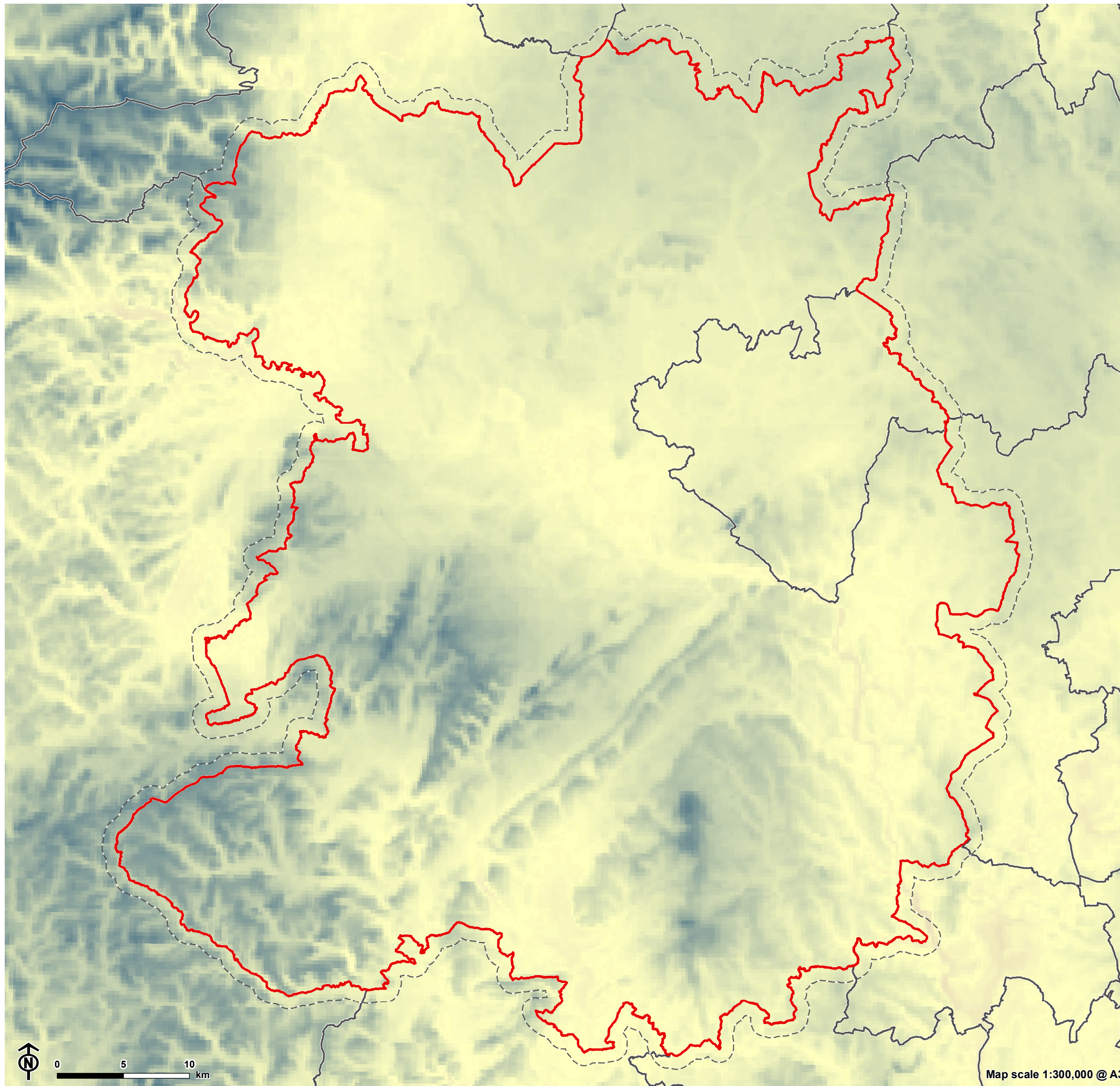


- Shropshire
  - Shropshire 1km Buffer
  - Neighbouring Local Authority
- Wind speed (m/s)**  
High : 15  
Low : 4



Map scale 1:300,000 @ A3

Figure 3.29: Wind: Additional opportunities to consider for prioritisation – Windspeeds at 200m height (large scale turbines)



- Shropshire
  - Shropshire 1km Buffer
  - Neighbouring Local Authority
- Wind speed (m/s)**  
High : 15  
Low : 4

**3.9** Figure 3.30 and Table 3.3 below provide a summary of the technical potential for wind energy within Shropshire. The assessment results indicate that there is a technical potential to deliver up to around 11,942 MW of wind energy capacity and a carbon saving of 4,241 kilotonnes of CO<sub>2</sub> per year in Shropshire, with the greatest technical potential identified for small turbines (see Figure 3.30 and Table 3.3).

Figure 3.30: Onshore wind potential capacity and carbon savings within Shropshire

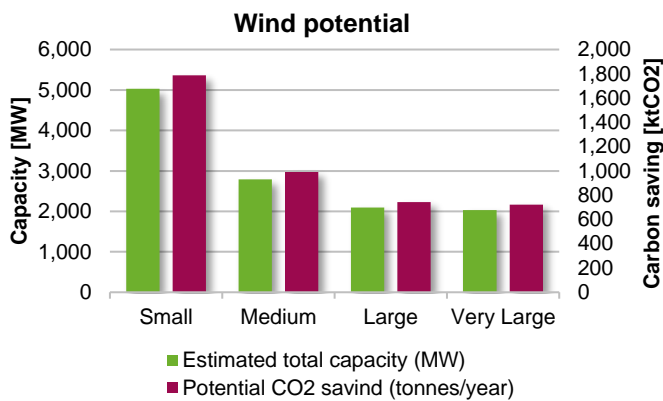


Table 3.3: Onshore wind potential capacity, output and carbon savings within Shropshire<sup>16</sup>

| Development Scale | Estimated total capacity (MW) | Electricity output (GWh/year) | Potential CO <sub>2</sub> savings (kilotonnes/yr) |
|-------------------|-------------------------------|-------------------------------|---|
| Very Large        | 2,029                         | 3,092                         | 720   |
| Large             | 2,091                         | 3,187                         | 742   |
| Medium            | 2,788                         | 4,250                         | 990   |
| Small             | 5,033                         | 7,671                         | 1,787   |
| <b>Total</b>      | <b>11,942</b>                 | <b>18,202</b>                 | <b>4,241</b>                                      |

**3.10** Of the identified land that is technically suitable, it was identified that there is technical potential to deliver up to around 1,602 MW of wind energy capacity and a carbon saving of 569 kilotonnes of CO<sub>2</sub> per year within opportunity areas, i.e. those in close proximity to A roads and motorway junctions (see Appendix B). The greatest technical potential identified was for small turbines (see Figure 3.31 and Table 3.4).

Figure 3.31: Onshore wind potential capacity and carbon savings within opportunity areas

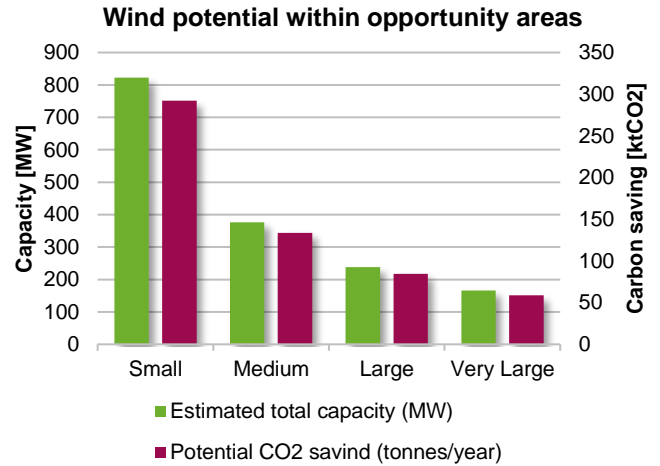


Table 3.4: Onshore wind potential capacity, output and carbon savings within opportunity areas<sup>17</sup>

| Development Scale | Estimated total capacity (MW) | Electricity output (GWh/year) | Potential CO <sub>2</sub> savings (kilotonnes/yr) |
|-------------------|-------------------------------|-------------------------------|---|
| Very Large        | 165                           | 252                           | 58  |
| Large             | 237                           | 362                           | 84  |
| Medium            | 376                           | 573                           | 133   |
| Small             | 822                           | 1,253                         | 292   |
| <b>Total</b>      | <b>1,602</b>                  | <b>2,442</b>                  | <b>569</b>  |

**3.11** As with the solar resource assessment, the wind assessment has certain limitations in addition to those listed in Chapter 2:

- **Wind data** – it is important to note that the macro-scale wind data which was used for this assessment can be inaccurate at the site-specific level and therefore can only be used to give a high-level indication of potential capacity and output within Shropshire. Developers will normally require wind speeds to be accurately monitored using anemometers for an extended period (typically at least one to two years) for commercial scale developments.
- **Cumulative effects** – multiple wind turbine developments can have a variety of cumulative effects.

<sup>16</sup> Note that the area of unconstrained land is treated as a single block of land. This is not the case in reality. Note that land available for very large turbines will also be suitable for large, medium and small turbines; land available for large turbines will also be suitable for medium and small turbines; and land available for medium turbines will also be suitable for small turbines.

<sup>17</sup> Note that the area of unconstrained land is treated as a single block of land. This is not the case in reality. Note that land available for very large turbines will also be suitable for large, medium and small turbines; land available for large turbines will also be suitable for medium and small turbines; and land available for medium turbines will also be suitable for small turbines.

Cumulative landscape and visual effects, in particular, would clearly occur if all the identified small wind development potential were to be realised. Cumulative effects, however, cannot be taken into account in a high-level assessment of this nature and must be considered on a development-by-development basis.

- **Site-specific features and characteristics** – in practice, developments outside protected areas may potentially impact on amenity and sensitive ‘receptors’ such as protected species. These impacts can only be assessed via a site-specific survey.
- **Aviation** – although operational airports and airfields, as well as MOD land, were considered to be constraints on wind development, aviation interests were not used to define potentially suitable land as impacts and mitigation need to be considered on a development-by-development basis.
- **Issues affecting deployability** – This study has assessed the technical potential for the development of wind turbines. Certain limitations of the resource assessment with respect to deployable wind potential have already been noted in the previous section. For example, cumulative impacts can only be considered fully when developments come forward in practice, but would generally be expected to reduce the overall deployable capacity. In addition to this, there are four particular factors that will influence the deployable potential of wind generation: landscape sensitivity, grid connection, development income and planning issues. These factors would also need to be considered when determining the suitability of a site for development.

## Chapter 4

### Next Steps

**4.1** The findings and mapping produced by this study have identified, at a high level, land within Shropshire that has technical potential to deliver wind and ground-mounted solar generation developments.

**4.2** This can be used by grid operators, potential developers, major energy users and other stakeholders to indicate what future infrastructure may be needed to support the journey towards net zero carbon Shropshire by 2030. In addition, the findings could be used to identify potential opportunities for these renewable developments, and further site-specific study could be undertaken to identify the feasibility of individual sites for ground-mounted solar and wind developments.

**4.3** Further high-level study could also be undertaken to identify the technical potential for other renewable technologies within the county, such as biomass and roof-mounted solar PV.

**4.4** With regards to future wind development within Shropshire, it is noted that current national policy states that wind turbines will only be considered acceptable within *“an area identified as suitable for wind energy development in the development plan; and, following consultation, it can be demonstrated that the planning impacts identified by the affected local community have been fully addressed and the proposal has their backing”*<sup>18</sup>. Therefore, in order for any deployable wind developments to be delivered within Shropshire, the Local Councils would need to undertake further work in addition to this study in order to identify and designate areas suitable for wind energy within the county.

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<sup>18</sup> Ministry of Housing, Communities and Local Government (2021) National Planning Policy Framework. Available at:

<https://www.gov.uk/government/publications/national-planning-policy-framework--2>. Paragraph 158, footnote 54.

## **Appendix A**

### **Ground-Mounted Solar Assessment Assumptions**

## Primary Constraints

Land covered by these constraints was excluded as they are considered to have no potential for ground-mounted solar development.

Table A - 1: Ground-mounted solar resource assessment primary constraints

| Parameter               | Assumption   | Data source   | Justification and Notes  |
|-------------------------|--|---|--|
| <b>Solar Irradiance</b> | Exclude: <ul style="list-style-type: none"> <li>An average annual generation exceeding 1000kWh/kWp<sup>19</sup> for a south facing, 38° tilted system. No shading taken into account.</li> </ul> | <ul style="list-style-type: none"> <li>Global Solar Atlas</li> </ul>            | Nearly all of Shropshire is considered theoretically suitable for ground-mounted solar development.  |
| <b>Roads</b>            | Exclude: <ul style="list-style-type: none"> <li>Roads</li> </ul>   | <ul style="list-style-type: none"> <li>Ordnance Survey OpenRoads</li> </ul>     | Physical features preventing the development of ground-mounted solar PV were excluded. All roads were excluded. There is no requirement for safety buffers in relation to these with respect to ground-mounted solar PV.<br><br>Note: Only line data for roads was available and in order to create a footprint from the road centre, it was assumed that single carriageways are 10m in width, dual carriageways 20m and motorways 30m.   |
| <b>Railways</b>         | Exclude: <ul style="list-style-type: none"> <li>Railways</li> </ul>  | <ul style="list-style-type: none"> <li>Ordnance Survey OpenMap Local</li> </ul> | Physical features preventing the development of ground-mounted solar PV were excluded. There is no requirement for safety buffers in relation to these with respect to ground-mounted solar PV.<br><br>Note: In order to create a footprint from the railway centrelines data, it was assumed that railways were 15m in width.   |
| <b>Gas mains</b>        | Exclude: <ul style="list-style-type: none"> <li>Gas pipelines</li> </ul>   | <ul style="list-style-type: none"> <li>National Grid</li> </ul>                 | Physical features that may prevent the development of ground-mounted solar PV were excluded.<br><br>Site specific assessment would be required to consider local pipelines and to determine the necessity for safety buffers. In some circumstances, corrosion interactions between metal pipes and PV panel ground supports may be a risk.<br><br>Note: In order to create a footprint from the gas pipelines centrelines data, it was assumed that pipelines were 2m in width. |

<sup>19</sup> Kilo-watt peak (the maximum electrical power under standard conditions).

| Parameter                                     | Assumption   | Data source  | Justification and Notes   |
|---|--|--|---|
| <b>Public Rights of Way<br/>Cycle Paths</b>   | Exclude: <ul style="list-style-type: none"> <li>Public Rights of Way</li> <li>Cycle paths</li> </ul>   | <ul style="list-style-type: none"> <li>Natural England</li> <li>SusTrans</li> <li>ROW Maps</li> </ul>      | <p>Physical features preventing the development of ground-mounted solar PV were excluded. There is no requirement for safety buffers in relation to these with respect to ground-mounted solar PV.</p> <p>Note: In order to create a footprint from the Public Rights of Way and cycle path centrelines data, it was assumed that Public Rights of Way and Bridleways are 2m in width.</p>  |
| <b>Open Space</b>                             | Exclude: <ul style="list-style-type: none"> <li>Common Land</li> <li>Green space</li> </ul>  | <ul style="list-style-type: none"> <li>Natural England (Common Land)</li> <li>OS OpenGreenspace</li> </ul> | <p>Due to land take requirements, these land uses/types were considered to constrain ground-mounted solar development, particularly at larger scales, although in some circumstances they may offer opportunities for smaller scale development collocated with their other facilities. They were excluded from the resource assessment but may be subject to bespoke policies with the Local Plan allowing development to take place in principle subject to defined criteria being satisfied.</p> |
| <b>Transmission lines</b>                     | Exclude <ul style="list-style-type: none"> <li>Line data buffered by 1m, forming a 2m shading exclusion footprint</li> </ul>                                     | <ul style="list-style-type: none"> <li>National Grid</li> <li>WPD</li> <li>SPEN</li> </ul>                 | <p>Physical features preventing the development of ground-mounted solar PV were excluded. There is no requirement for safety buffers in relation to these with respect to ground-mounted solar PV.</p> <p>This exclusion was applied to account for shading and impacts on solar output.</p>  |
| <b>Buildings</b>                              | Exclude: <ul style="list-style-type: none"> <li>All buildings with a 20m buffer</li> </ul>   | <ul style="list-style-type: none"> <li>OS OpenMap Local data</li> </ul>                                    | <p>Buildings were buffered by 20m to account for shading and impacts on solar output.</p>   |
| <b>Airfields and Airports</b>                 | Exclude: <ul style="list-style-type: none"> <li>Operational airports and airfields</li> </ul>  | <ul style="list-style-type: none"> <li>Ordnance Survey OpenMap</li> </ul>                                  | <p>OS OpenMap Local Functional Site data with the theme Air Transport was used in the assessment</p>  |
| <b>MOD Land</b>                               | Exclude: <ul style="list-style-type: none"> <li>MOD land</li> </ul>  | <ul style="list-style-type: none"> <li>Open Street Map</li> <li>OS 1:25000 mapping</li> </ul>              | <p>Landholdings were digitised against OS 1:25000 mapping.</p>  |
| <b>Existing Renewable Energy Developments</b> | Exclude: <ul style="list-style-type: none"> <li>Consented and operational ground-mounted solar energy installations, defined by their land boundaries</li> </ul> | <ul style="list-style-type: none"> <li>BEIS</li> <li>Land Registry</li> <li>Aerial imagery</li> </ul>      | <p>The quarterly BEIS Renewable Energy Planning Database was used to determine the locations of operational and consented renewable energy installations. To approximate the site boundary, land was excluded based on the Inspire Land boundary polygon associated with the point location (data obtained from the Land Registry) in combination with assessment of surrounding recent aerial imagery.</p>   |

| Parameter  | Assumption   | Data source   | Justification and Notes   |
|--|--|---|---|
| <b>Terrain</b>                                   | Exclude: <ul style="list-style-type: none"> <li>• Areas with north-east to north-west aspect and inclinations greater than 3 degrees</li> <li>• All areas with inclinations greater than 10 degrees</li> </ul> | <ul style="list-style-type: none"> <li>• OS Terrain 50</li> </ul>   | <p>Although it is possible to develop ground-mounted solar PV installations on slopes facing north-east to north-west, it would generally not be economically viable to do so. However, slopes that are north-east to north-west facing and below 3° are considered potentially suitable, as generation output will not be significantly affected.</p> <p>It is noted that site specific assessment will be required to identify if terrain surrounding a site may present accessibility issues to the site itself.</p> |
| <b>Agricultural Land Use</b>                     | Exclude: <ul style="list-style-type: none"> <li>• Agricultural land use classifications grades 1 and 2</li> </ul>  | <ul style="list-style-type: none"> <li>• Natural England</li> </ul>   | <p>Agricultural land use is a consideration, with grades 1 and 2 land having higher value for food production. Further investigation would be required of grade 3 land to determine whether it is grade 3a or b, as available data does not distinguish these. Ground-mounted solar PV projects over 50kWp should ideally utilise previously developed land, brownfield land, contaminated land, industrial land or agricultural land, preferably of classification 3b, 4, and 5.</p>                                   |
| <b>Water Environment</b>                         | Exclude: <ul style="list-style-type: none"> <li>• Watercourses and waterbodies.</li> </ul>   | <ul style="list-style-type: none"> <li>• Ordnance Survey OpenRivers</li> <li>• Ordnance Survey OpenMap Local</li> </ul> | <p>Physical features preventing the development of ground-mounted solar PV were excluded. There is no requirement for safety buffers in relation to these with respect to ground-mounted solar PV.</p> <p>OS VectorMap District surface water data includes waterways of approximately a minimum of 2m width. OS Rivers data is line data, and so a 1m buffer was applied to approximate a footprint of smaller waterways.</p>  |
| <b>Woodland</b>                                  | Exclude: <ul style="list-style-type: none"> <li>• Woodland as shown on the National Forest Inventory 2018 and Ancient Woodland Inventory with a 20m buffer</li> </ul>  | <ul style="list-style-type: none"> <li>• Forestry Commission</li> <li>• Natural England</li> <li>• NRW</li> </ul>       | <p>Forested areas were buffered by 20m to account for shading and impacts on solar output.</p>  |
| <b>Biodiversity (International designations)</b> | Exclude international designations <sup>20</sup> : <ul style="list-style-type: none"> <li>• Special Areas of Conservation</li> <li>• Ramsar sites</li> </ul>   | <ul style="list-style-type: none"> <li>• Natural England</li> </ul>   | <p>As protected by:</p> <ul style="list-style-type: none"> <li>• Conservation of Habitats and Species Regulations 2017 (as amended).</li> </ul>   |

<sup>20</sup> There are no Special Protection Areas, potential Special Protection Areas, potential Special Areas of Conservation or proposed Ramsar sites located within 1km of Shropshire.

| Parameter   | Assumption  | Data source  | Justification and Notes  |
|---|---|--|--|
| <b>Biodiversity (National designations)</b>           | Exclude national designations: <ul style="list-style-type: none"> <li>Sites of Special Scientific Interest</li> <li>National Nature Reserves</li> </ul>   | <ul style="list-style-type: none"> <li>Natural England</li> </ul>  | As protected by: <ul style="list-style-type: none"> <li>Wildlife and Countryside Act 1981.</li> <li>Conservation of Habitats and Species Regulations 2017 (as amended).</li> </ul>   |
| <b>Biodiversity (Regional and local designations)</b> | Exclude other designations <sup>21</sup> : <ul style="list-style-type: none"> <li>Local Nature Reserves</li> </ul>  | <ul style="list-style-type: none"> <li>Natural England</li> </ul>  | Generally, would not be suitable for renewables development based on law/policy/guidance including: <ul style="list-style-type: none"> <li>National Planning Policy Framework.</li> <li>Natural Environment and Rural Communities Act 2006.</li> </ul>   |
| <b>Cultural heritage</b>                              | Exclude: <ul style="list-style-type: none"> <li>World Heritage Sites</li> <li>Registered parks and gardens</li> <li>Registered battlefields</li> <li>Scheduled monuments</li> <li>Listed buildings</li> </ul> | <ul style="list-style-type: none"> <li>Historic England</li> </ul> | As protected by: <ul style="list-style-type: none"> <li>National Planning Policy Framework.</li> <li>The Convention Concerning the Protection of the World Cultural and Natural Heritage.</li> <li>National Heritage Act 1983.</li> <li>Ancient Monuments and Archaeological Areas Act of 1979.</li> <li>Planning (Listed Buildings and Conservation Areas) Act 1990.</li> </ul> <p>Note: Listed building point data was buffered 5m to estimate building footprint.</p> |

## Secondary Opportunities and Considerations

### Secondary Opportunities

Land identified to have technical potential for ground-mounted solar generation within these secondary opportunities were identified as opportunity areas for ground-mounted solar generation.

Table A - 2: Ground-mounted solar resource assessment secondary opportunities

| Parameter    | Assumption  | Data source  | Justification and Notes   |
|--------------|---|--|---|
| <b>Roads</b> | Score 1 for land that: <ul style="list-style-type: none"> <li>Is located within 500m of a main road (A Road) or motorway junction.</li> </ul> | <ul style="list-style-type: none"> <li>OS OpenRoads</li> </ul> | Ground-mounted solar sites are likely to be more deliverable if located in closer proximity to existing road networks suitable for HGVs. <p>Note: Only line data for roads was available and in order to create a footprint from the road centre, it was assumed that single carriageways are 10m in width and dual carriageways 20m.</p> |

<sup>21</sup> There are no RSPB Reserves located within 1km of Shropshire.

| Parameter               | Assumption   | Data source   | Justification and Notes   |
|-------------------------|--|---|---|
| <b>Electricity Grid</b> | Score 1 for land that: <ul style="list-style-type: none"> <li>Is located within 3km of a substation.</li> </ul> Score an additional 1 for land parcels that: <ul style="list-style-type: none"> <li>Are located within 1km of a substation.</li> </ul> | <ul style="list-style-type: none"> <li>National Grid</li> <li>Weston Power Distribution and SPEN</li> </ul> | Ground-mounted solar sites are likely to be more deliverable and less costly to develop if located closer to existing electricity infrastructure. |

### Secondary Considerations

Land within opportunity areas for ground-mounted solar generation were overlaid with these secondary considerations.

Table A - 3: Ground-mounted solar resource assessment secondary considerations

| Parameter  | Assumption   | Data source  | Justification and Notes   |
|--|--|--|---|
| <b>AONB</b>                                      | Score 1 for land that is: <ul style="list-style-type: none"> <li>Located within or within 1km of an AONB</li> </ul>  | <ul style="list-style-type: none"> <li>Natural England</li> <li>NRW</li> </ul> | The Shropshire Hills AONB Management Plan <sup>22</sup> does not entirely restrict ground-mounted solar development within the AONB, however planning permission may be more difficult to obtain for sites within or close to the designation.  |
| <b>Biodiversity (International designations)</b> | Score 1 for land located within 1km of international designations <sup>23</sup> : <ul style="list-style-type: none"> <li>Special Areas of Conservation</li> <li>Ramsar sites<sup>24</sup></li> </ul> | <ul style="list-style-type: none"> <li>Natural England</li> <li>NRW</li> </ul> | As protected by: <ul style="list-style-type: none"> <li>Conservation of Habitats and Species Regulations 2017 (as amended).</li> </ul> Ground-mounted solar development may be appropriate in close proximity to some designations, however planning permission may be more difficult to obtain for sites close to such designations.   |
| <b>Biodiversity (National designations)</b>      | Score 1 for land located within 1km of national designations: <ul style="list-style-type: none"> <li>Sites of Special Scientific Interest</li> <li>National Nature Reserves</li> </ul>               | <ul style="list-style-type: none"> <li>Natural England</li> <li>NRW</li> </ul> | As protected by: <ul style="list-style-type: none"> <li>Wildlife and Countryside Act 1981.</li> <li>Conservation of Habitats and Species Regulations 2017 (as amended).</li> </ul> Ground-mounted solar development may be appropriate in close proximity to some designations, however planning permission may be more difficult to obtain for sites close to such designations. |

<sup>22</sup> Shropshire Hills AONB Partnership (2019) Shropshire Hills AONB 2019 - 24 Management Plan. Available at: <https://www.shropshirehillsaonb.co.uk/a-special-place/aonb-management-plan/2019-24-management-plan>.

<sup>23</sup> There are no Special Protection Areas, potential Special Protection Areas, potential Special Areas of Conservation or proposed Ramsar sites located within 1km of Shropshire.

<sup>24</sup> Wetlands of international importance designated under the Ramsar Convention

| Parameter   | Assumption  | Data source  | Justification and Notes  |
|---|---|--|--|
| <b>Biodiversity (Regional and local designations)</b> | Score 1 for land located within 1km of other designations <sup>25</sup> : <ul style="list-style-type: none"> <li>Local Nature Reserves</li> </ul>   | <ul style="list-style-type: none"> <li>Natural England</li> </ul>                | <p>As protected by:</p> <ul style="list-style-type: none"> <li>National Planning Policy Framework.</li> <li>Natural Environment and Rural Communities Act 2006.</li> </ul> <p>Ground-mounted solar development may be appropriate in close proximity to some designations, however planning permission may be more difficult to obtain for sites close to such designations.</p>   |
| <b>Cultural heritage</b>                              | Score 1 for land located within 1km of: <ul style="list-style-type: none"> <li>World Heritage Sites</li> <li>Registered parks and gardens</li> <li>Registered Battlefields</li> <li>Scheduled monuments</li> <li>Listed buildings</li> </ul> <p>Score 1 for land that is:</p> <ul style="list-style-type: none"> <li>Located within or within 1km of a Registered Historic Landscape</li> </ul> | <ul style="list-style-type: none"> <li>Historic England</li> <li>Cadw</li> </ul> | <p>As protected by:</p> <ul style="list-style-type: none"> <li>National Planning Policy Framework.</li> <li>Planning Policy Wales.</li> <li>The Convention Concerning the Protection of the World Cultural and Natural Heritage.</li> <li>National Heritage Act 1983.</li> <li>Ancient Monuments and Archaeological Areas Act of 1979.</li> <li>Planning (Listed Buildings and Conservation Areas) Act 1990.</li> </ul> <p>Note: Point data was buffered 5m to estimate building footprint.</p> <p>The Cadw dataset of Historic Parks and Gardens has not yet been published and so land in proximity to Welsh Historic Parks and Gardens was not able to be considered.</p> <p>Ground-mounted solar development may be appropriate in close proximity to some designations, however planning permission may be more difficult to obtain for sites close to such designations.</p> |
| <b>Country Parks</b>                                  | Score 1 for land that is: <ul style="list-style-type: none"> <li>Located within or within 1km of a Country Park.</li> </ul>   | <ul style="list-style-type: none"> <li>Natural England</li> </ul>                | <p>Ground-mounted solar development may be appropriate within or in close proximity to some country parks, however planning permission may be more difficult to obtain for sites within or close to country parks.</p>   |
| <b>Flood Zones</b>                                    | Score 1 for land that is: <ul style="list-style-type: none"> <li>Located within Flood Zone 3.</li> </ul>  | <ul style="list-style-type: none"> <li>EA</li> </ul>                             | <p>Ground-mounted solar development will not necessarily be infeasible within areas of greater flood risk, however the delivery of ground-mounted solar development in such locations may be more complex and costly.</p>  |

<sup>25</sup> There are no RSPB Reserves located within Shropshire.

### Additional Opportunities

When assessing the deployable potential of individual land parcels for ground-mounted solar generation, the following additional opportunities could be considered. These opportunities were mapped separately (**Figure 3.5**), however did not form part of the main secondary opportunities mapping (**Figure 3.2**). The reason for this being that the brownfield land datasets contain only point data that could not be accurately overlaid, and existing and potential wind co-location opportunities would require site-specific assessment to determine their suitability.

Table A - 4: Ground-mounted solar resource assessment additional opportunities

| Parameter   | Assumption  | Data source  | Justification and Notes   |
|---|---|--|---|
| <b>Brownfield Land</b>                                    | Additional opportunities for land that: <ul style="list-style-type: none"> <li>Contains brownfield land.</li> </ul>                               | <ul style="list-style-type: none"> <li>Open Shropshire Council and Telford and Wrekin Brownfield Land Register points</li> </ul> | Developments that re-use previously developed land are more likely to be considered more favourably when being considered for planning permission.  |
| <b>Existing Renewable Energy Developments</b>             | Additional opportunities for land that: <ul style="list-style-type: none"> <li>Contains existing or consented wind developments.</li> </ul>       | <ul style="list-style-type: none"> <li>BEIS</li> </ul>   | <p>The BEIS quarterly renewable energy database was used to determine the locations of operational and consented renewable energy installations. It was then cross-referenced with Inspire Land boundary data obtained from the Land Registry.</p> <p>Co-locating developments may make developments more deliverable, such as through reduced construction costs, use of shared infrastructure, and increased continuity of supply to compensate for intermittencies in generation.</p> <p>In addition, the colocation of ground-mounted solar panels at wind developments can increase the generation efficiency of the site in comparison to the land take required.</p> <p>However, there is no record of existing wind farm developments within Shropshire to provide co-location opportunities.</p> |
| <b>Identified areas of potential for wind development</b> | Additional opportunities for land that: <ul style="list-style-type: none"> <li>Contains identified land parcels for wind developments.</li> </ul> | <ul style="list-style-type: none"> <li>LUC</li> </ul>  | <p>Co-locating developments may make developments more deliverable, such as through reduced construction costs, use of shared infrastructure, and increased continuity of supply to compensate for intermittencies in generation.</p> <p>In addition, the colocation of ground-mounted solar panels at wind developments can increase the generation efficiency of the site in comparison to the land take required.</p>  |

## **Appendix B**

### **Wind Assessment Assumptions**

## Primary Constraints

Land covered by these constraints was excluded as they are considered to have no potential for wind development.

Table B - 1: Wind resource assessment primary constraints

| Parameter                | Assumption   | Data source   | Justification and Notes   |
|--------------------------|--|---|---|
| <b>Wind turbine size</b> | <p>Five turbine sizes were considered:</p> <ul style="list-style-type: none"> <li>• Very large (150-200m tip height)</li> <li>• Large (100-150m tip height)</li> <li>• Medium (60-100m tip height)</li> <li>• Small (25-60m tip height)</li> <li>• Very small (&lt;25m height)</li> </ul> <p>Assessment was based on notional turbine sizes, approximately intermediate within each class size i.e.</p> <ul style="list-style-type: none"> <li>• Very large: 175m tip height</li> <li>• Large: 125m tip height</li> <li>• Medium: 80m tip height</li> <li>• Small: 45m tip height</li> </ul> <p>No map-based assessment of 'very small' turbines was undertaken. The type of buffers applied to constraints for the assessment of other turbine size categories in many cases do not apply to very small turbines. Equally, mapping a strategic county-wide 'resource' for very small turbines (which are generally developed singly in association with particular farm or other buildings) is not particularly meaningful. Instead, it is recommended the entire county, with the exception of exclusionary land use constraints, is considered to be technically suitable for very small wind in principle (subject to site-specific assessment).</p> | <ul style="list-style-type: none"> <li>• LUC</li> <li>• Research into turbine manufacturers</li> <li>• BEIS renewable energy planning database and other databases containing information on wind turbine applications</li> </ul> | <p>There are no standard categories for wind turbine sizes. The categories chosen are based on consideration of currently and historically 'typical' turbine models at various different scales. The approach is intended to be flexible in the light of uncertainty regarding future financial support for renewable energy.</p> <p>A review of wind turbine applications across the UK showed tip heights ranging from less than 20m up to around 200m, with larger turbine models in demand from developers following the reduction in financial support from Government. The majority of operational and planned turbines range between 80m and 175m.</p> <p>Due to the structure of the financial support system in the past, smaller turbines (those in the medium to small categories) have tended to be deployed as 1-2 turbine developments.</p> |

| Parameter         | Assumption  | Data source   | Justification and Notes   |
|-------------------|---|---|---|
| <b>Wind Speed</b> | <p>Exclude:</p> <ul style="list-style-type: none"> <li>All areas with mean annual average wind speed &lt;5 m/s at 50m above ground level (agl)</li> </ul>   | <ul style="list-style-type: none"> <li>Global Wind Atlas/Vortex</li> <li>Industry practice</li> </ul> | <p>All of Shropshire meets or exceeds the minimum requirement of 5m/s.</p> <p>Wind speed requirements change with turbine scale and model. Some turbine manufacturers produce models which may operate at lower wind speeds and the configuration of certain turbine models can be altered to improve yield in lower wind speed environments.</p> <p>Future changes in government policy and turbine technology could allow developments to be deliverable at lower wind speeds than are currently viable. A 5m/s threshold was applied to take account of such changes.</p>  |
| <b>Roads</b>      | <p>Exclude:</p> <ul style="list-style-type: none"> <li>Roads with a buffer of <ul style="list-style-type: none"> <li>the height of the turbine (to blade tip height) +50m (Large and Very Large scales)</li> <li>the height of the turbine (to blade tip) x 1.5 (Medium and Small scales).</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>Ordnance Survey OpenRoads</li> </ul>                           | <p>These buffers were applied as a safety consideration. The proposed buffer distance is based on Department for Transport/Highways Agency guidance (2013)<sup>26</sup> as referenced in National Planning Practice Guidance (NPPG). This guidance relates explicitly to the strategic road network, but as guidance is lacking relating to other roads, the same approach was applied to all roads for the purposes of consistency. The guidance states that different buffers should be applied based on the scale of the turbine being proposed.</p> <p>Note: Only line data for roads was available and in order to create a footprint from the road centre, it was assumed that single carriageways are 10m in width, dual carriageways 20m and motorways 30m.</p> |
| <b>Railways</b>   | <p>Exclude:</p> <ul style="list-style-type: none"> <li>Railways with a buffer of <ul style="list-style-type: none"> <li>the height of the turbine (to blade tip) +50m (Large and Very Large scales)</li> <li>the height of the turbine (to blade tip) x 1.5 (Medium and Small scales)</li> </ul> </li> </ul>      | <ul style="list-style-type: none"> <li>Ordnance Survey OpenMap Local</li> </ul>                       | <p>This buffer was applied as a safety consideration, based on the same principles as used for roads.</p> <p>Note: In order to create a footprint from the railway centrelines data, it was assumed that railways are 15m in width.</p>   |

<sup>26</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/237412/dft-circular-strategic-road.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/237412/dft-circular-strategic-road.pdf)

**Appendix B**  
Wind Assessment Assumptions

Shropshire Renewable Energy Opportunity Map  
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| Parameter                                   | Assumption   | Data source  | Justification and Notes   |
|---|--|--|---|
| <b>Gas mains</b>                            | Exclude: <ul style="list-style-type: none"> <li>Gas pipelines with a buffer of the height of the turbine (to blade tip height) i.e. topple distance</li> </ul>   | <ul style="list-style-type: none"> <li>National Grid</li> </ul>  | <p>This buffer was applied as a safety consideration. However, site specific assessment would be required to consider local pipelines and to determine the necessity for any variations in safety buffers.</p> <p>Note: In order to create a footprint from the gas pipelines centrelines data, it was assumed that pipelines were 2m in width.</p>   |
| <b>Public Rights of Way<br/>Cycle Paths</b> | Exclude: <ul style="list-style-type: none"> <li>Public Rights of Way and cycle paths with a buffer of the height of the turbine (to blade tip height) i.e. topple distance</li> </ul>  | <ul style="list-style-type: none"> <li>Natural England</li> <li>NRW</li> <li>SusTrans</li> <li>ROW Maps</li> </ul> | <p>This buffer was applied as a safety consideration.</p> <p>There has never been any statutory requirement relating to separation distances between wind turbines and pedestrian, equestrian and cycle routes. Applying a general separation distance based on tip height ('topple distance') is considered a reasonable approach, and was cited as a suitable buffer in the Companion Guide to Planning Policy Statement 22.</p> <p>Note: In order to create a footprint from the Public Rights of Way and cycle path centrelines data, it was assumed that Public Rights of Way, Bridleways and cycle paths are 2m in width.</p> |
| <b>Transmission lines</b>                   | Exclude: <ul style="list-style-type: none"> <li>Transmission lines with a buffer of the height of the turbine (to blade tip height) +10%.</li> </ul>   | <ul style="list-style-type: none"> <li>National Grid</li> <li>Weston Power Distribution and SPEN</li> </ul>        | <p>This buffer was applied as a safety consideration. It is derived from guidance by the Energy Networks Association (Engineering Recommendation L44) and National Grid (Technical Advice Note 287)</p>   |
| <b>Airports and Airfields</b>               | Exclude: <ul style="list-style-type: none"> <li>Operational airports and airfields</li> </ul>  | <ul style="list-style-type: none"> <li>Ordnance Survey OpenMap</li> </ul>  | <p>OS OpenMap Local Functional Site data with the theme Air Transport was used in the assessment</p>  |
| <b>MOD Land</b>                             | Exclude: <ul style="list-style-type: none"> <li>MOD land in active use</li> </ul>  | <ul style="list-style-type: none"> <li>Open Street Map</li> </ul>  | <p>Landholdings were digitised against OS mapping.</p>  |
| <b>Noise</b>                                | Exclude: <ul style="list-style-type: none"> <li>Indicative commercial property buffer zones based on turbine size: <ul style="list-style-type: none"> <li>Very large scale: 250m for non-sensitive properties.</li> <li>Large scale: 230m for non-sensitive properties.</li> <li>Medium scale: 180m for non-sensitive properties.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>OS OpenMap Local Buildings layer</li> </ul>                                 | <p>Wind turbines generate sound during their operation, and their noise impacts upon nearby properties must be limited to appropriate levels, defined in particular by the 'ETSU' Guidance – The Assessment and Rating of Noise from Wind Farms (1995) (as supplemented by the Institute of Acoustics). The relationship between turbine size and the separation distance from properties at which acceptable noise levels will be achieved is, in practice, complex and variable. However, the present assessment has applied specialist acoustic advice to define minimum distances below which it is generally</p>               |

| Parameter                                     | Assumption   | Data source   | Justification and Notes  |
|---|--|---|--|
|   | <ul style="list-style-type: none"> <li>o Small scale: 80m for non-sensitive properties.</li> </ul> <p>Indicative buffers were applied to the available buildings data from OS OpenMap. As this data does not distinguish commercial and residential properties/sensitive receptors<sup>27</sup>, and it was not possible to verify uses by other means, buffers applicable for commercial properties were used throughout, with the aim to identify the largest area of land that is potentially suitable for development with regards to noise impacts.</p> <p>Indicative noise buffers were also applied to the available building data using the larger buffers applicable to residential/sensitive receptors as part of the secondary considerations considered (see <b>Table B - 3</b>)</p> |   | <p>unlikely that the required noise levels under ETSU-R-97 will be achievable.</p> <p>The approach taken necessarily involves applying various assumptions, including:</p> <ul style="list-style-type: none"> <li>- single turbine development in all cases (rather than multiple turbines)</li> <li>- that no properties will be 'financially involved' in the wind development (financial involvement may allow higher noise levels to be accepted in individual cases).</li> </ul> <p>The limitations associated with such assumptions are considered preferable to avoiding the use of noise-related separation distances for the assessment, bearing in mind that noise is a key factor that influences the acceptable siting of turbines in practice. The assessment defines the <i>minimum</i> distances below which adherence to the Industry standard (ETSU-R-97) noise guidance would not be possible and it should not be inferred that the proposed distances represent acceptance of any given proposal within the areas of identified suitable potential as site based noise monitoring and assessments would still be required.</p> |
| <b>Existing Renewable Energy Developments</b> | <p>Exclude:</p> <ul style="list-style-type: none"> <li>• Land boundaries of consented and operational renewable energy installations</li> </ul>  | <ul style="list-style-type: none"> <li>• BEIS</li> <li>• Land Registry</li> <li>• Aerial imagery</li> </ul> | <p>The quarterly BEIS Renewable Energy Planning Database was used to determine the locations of operational and consented renewable energy installations. To approximate the site boundary, land was excluded based on the Inspire Land boundary polygon associated with the point location (data obtained from the Land Registry) in combination with assessment of surrounding recent aerial imagery.</p>  |
| <b>Terrain</b>                                | <p>Exclude:</p> <ul style="list-style-type: none"> <li>• Slopes greater than 15 degrees.</li> </ul>  | <ul style="list-style-type: none"> <li>• OS Terrain 50</li> </ul>   | <p>This is a development/ operational constraint. Developers have indicated that this is the maximum slope they would generally consider feasible for development. Although it is theoretically possible to develop on areas exceeding 15° slopes, turbine manufacturers are considered unlikely to allow turbine component delivery to sites where this is exceeded.</p> <p>It is noted that site specific assessment will be required to identify if terrain surrounding a site may present accessibility issues to the site itself.</p>   |

<sup>27</sup> Sensitive receptors to noise include: residential properties, education facilities, hospitals and care homes.

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| Parameter   | Assumption  | Data source   | Justification and Notes   |
|---|---|---|---|
| <b>Water Environment</b>                              | Exclude: <ul style="list-style-type: none"> <li>Watercourses and waterbodies with a 50m buffer.</li> </ul>  | <ul style="list-style-type: none"> <li>Ordnance Survey OpenRivers</li> <li>Ordnance Survey OpenMap Local</li> </ul> | <p>A 50m buffer was applied around all rivers and waterbodies to take account of good practice such as that relating to pollution control during construction.</p> <p>OS VectorMap District surface water data includes waterways of approximately a minimum of 2m width. OS Rivers data is line data, and so a 1m buffer was applied to approximate a footprint of smaller waterways.</p>  |
| <b>Woodland</b>                                       | Exclude: <ul style="list-style-type: none"> <li>Woodland as shown on the National Forest Inventory 2018 and Ancient Woodland Inventory with a 50m buffer.</li> </ul>  | <ul style="list-style-type: none"> <li>Forestry Commission</li> <li>Natural England</li> <li>NRW</li> </ul>         | <p>All areas of woodland were excluded with a + 50m buffer to reduce risk of impact on bats.</p> <p>A 50m clearance distance of turbines from trees and other habitat features is standard practice and endorsed by Natural England guidance set out in 'TIN051'. A 50m horizontal buffer is a reasonable proxy clearance for the purposes of a strategic study bearing in mind unknowns concerning tree height and turbine dimensions. A 50m buffer cannot be applied to all linear habitat features and individual trees due to a lack of data for a study of this scale.</p> |
| <b>Biodiversity (International designations)</b>      | Exclude international designations <sup>28</sup> : <ul style="list-style-type: none"> <li>Special Areas of Conservation</li> <li>Ramsar sites<sup>29</sup></li> </ul> | <ul style="list-style-type: none"> <li>Natural England</li> </ul>   | <p>As protected by:</p> <ul style="list-style-type: none"> <li>Conservation of Habitats and Species Regulations 2017 (as amended).</li> </ul>   |
| <b>Biodiversity (National designations)</b>           | Exclude national designations: <ul style="list-style-type: none"> <li>Sites of Special Scientific Interest</li> <li>National Nature Reserves</li> </ul>               | <ul style="list-style-type: none"> <li>Natural England</li> </ul>   | <p>As protected by:</p> <ul style="list-style-type: none"> <li>Wildlife and Countryside Act 1981.</li> <li>Conservation of Habitats and Species Regulations 2017 (as amended).</li> </ul>   |
| <b>Biodiversity (Regional and local designations)</b> | Exclude other designations <sup>30</sup> : <ul style="list-style-type: none"> <li>Local Nature Reserves</li> </ul>  | <ul style="list-style-type: none"> <li>Natural England</li> </ul>   | <p>Generally, would not be suitable for renewables development based on law/policy/guidance including:</p> <ul style="list-style-type: none"> <li>National Planning Policy Framework.</li> <li>Natural Environment and Rural Communities Act 2006.</li> </ul>   |

<sup>28</sup> There are no Special Protection Areas, potential Special Protection Areas, potential Special Areas of Conservation or proposed Ramsar sites located within 1km of Shropshire.

<sup>29</sup> Wetlands of international importance designated under the Ramsar Convention

<sup>30</sup> There are no RSPB Reserves located within 1km of Shropshire.

| Parameter                | Assumption   | Data source  | Justification and Notes   |
|--------------------------|--|--|---|
| <b>Cultural heritage</b> | <p>Exclude:</p> <ul style="list-style-type: none"> <li>World Heritage Sites</li> <li>Registered parks and gardens</li> <li>Registered Battlefields</li> <li>Scheduled monuments</li> <li>Listed buildings</li> </ul> | <ul style="list-style-type: none"> <li>Historic England</li> <li>Cadw</li> </ul> | <p>As protected by:</p> <ul style="list-style-type: none"> <li>National Planning Policy Framework.</li> <li>Planning Policy Wales.</li> <li>The Convention Concerning the Protection of the World Cultural and Natural Heritage.</li> <li>National Heritage Act 1983.</li> <li>Ancient Monuments and Archaeological Areas Act of 1979.</li> <li>Planning (Listed Buildings and Conservation Areas) Act 1990.</li> </ul> <p>Note: Point data was buffered 5m to estimate building footprint.</p> <p>The Cadw dataset of Historic Parks and Gardens has not yet been published and so land in proximity to Welsh Historic Parks and Gardens was not considered.</p> <p>Although datasets for conservation areas are openly available in Wales, they are not within England. Therefore, for consistency conservation areas were not treated as a constraint.</p> |

## Secondary Opportunities and Considerations

### Secondary Opportunities

Land identified to have technical potential for wind generation within these secondary opportunities were identified as opportunity areas for wind generation.

Table B - 2: Wind resource assessment secondary opportunities

| Parameter    | Assumption   | Data source  | Justification and Notes  |
|--------------|--|--|--|
| <b>Roads</b> | <p>Score 1 for land that:</p> <ul style="list-style-type: none"> <li>Is located within 500m of a main road (A Road) or motorway junction.</li> </ul> | <ul style="list-style-type: none"> <li>OS OpenRoads</li> </ul> | <p>Wind sites are likely to be more deliverable if located in closer proximity to existing road networks suitable for HGVs.</p> <p>Note: Only line data for roads was available and in order to create a footprint from the road centre, it was assumed that single carriageways are 10m in width and dual carriageways 20m.</p> |

## Secondary Considerations

Land within opportunity areas for wind generation were overlaid with these secondary considerations.

Table B - 3: Wind resource assessment secondary considerations

| Parameter   | Assumption  | Data source  | Justification and Notes   |
|---|---|--|---|
| <b>AONB</b>   | Score 1 for land that is: <ul style="list-style-type: none"> <li>Located within or within 1km of an AONB</li> </ul>   | <ul style="list-style-type: none"> <li>Natural England</li> <li>NRW</li> </ul> | The <u>Shropshire Hills AONB Management Plan</u> does not entirely restrict wind development within the AONB, however planning permission may be more difficult to obtain for sites within or close to the designation.   |
| <b>Biodiversity (International designations)</b>      | Score 1 for land located within 1km of international designations <sup>31</sup> : <ul style="list-style-type: none"> <li>Special Areas of Conservation</li> <li>Ramsar sites</li> </ul> | <ul style="list-style-type: none"> <li>Natural England</li> <li>NRW</li> </ul> | As protected by: <ul style="list-style-type: none"> <li>Conservation of Habitats and Species Regulations 2017 (as amended).</li> </ul> Wind development may be appropriate in close proximity to some designations, however planning permission may be more difficult to obtain for sites close to such designations.   |
| <b>Biodiversity (National designations)</b>           | Score 1 for land located within 1km of national designations: <ul style="list-style-type: none"> <li>Sites of Special Scientific Interest</li> <li>National Nature Reserves</li> </ul>  | <ul style="list-style-type: none"> <li>Natural England</li> <li>NRW</li> </ul> | As protected by: <ul style="list-style-type: none"> <li>Wildlife and Countryside Act 1981.</li> <li>Conservation of Habitats and Species Regulations 2017 (as amended).</li> </ul> Wind development may be appropriate in close proximity to some designations, however planning permission may be more difficult to obtain for sites close to such designations. |
| <b>Biodiversity (Regional and local designations)</b> | Score 1 for land located within 1km of other designations <sup>32</sup> :<br>Local Nature Reserves  | <ul style="list-style-type: none"> <li>Natural England</li> </ul>              | As protected by: <ul style="list-style-type: none"> <li>National Planning Policy Framework.</li> <li>Natural Environment and Rural Communities Act 2006.</li> </ul> Wind development may be appropriate in close proximity to some designations, however planning permission may be more difficult to obtain for sites close to such designations.                |

<sup>31</sup> There are no Special Protection Areas, potential Special Protection Areas, potential Special Areas of Conservation or proposed Ramsar sites located within 1km of Shropshire.

<sup>32</sup> There are no RSPB Reserves located within Shropshire.

**Appendix B**  
Wind Assessment Assumptions

Shropshire Renewable Energy Opportunity Map  
October 2021

| Parameter                | Assumption   | Data source  | Justification and Notes   |
|--------------------------|--|--|---|
| <b>Cultural heritage</b> | <p>Score 1 for land located within 1km of:</p> <ul style="list-style-type: none"> <li>World Heritage Sites</li> <li>Registered parks and gardens</li> <li>Registered Battlefields</li> <li>Scheduled monuments</li> <li>Listed buildings</li> </ul> <p>Score 1 for land that is:</p> <ul style="list-style-type: none"> <li>Located within or within 1km of a Registered Historic Landscape</li> </ul> | <ul style="list-style-type: none"> <li>Historic England</li> <li>Cadw</li> </ul> | <p>As protected by:</p> <ul style="list-style-type: none"> <li>National Planning Policy Framework.</li> <li>Planning Policy Wales.</li> <li>The Convention Concerning the Protection of the World Cultural and Natural Heritage.</li> <li>National Heritage Act 1983.</li> <li>Ancient Monuments and Archaeological Areas Act of 1979.</li> <li>Planning (Listed Buildings and Conservation Areas) Act 1990.</li> </ul> <p>Note: Point data was buffered 5m to estimate building footprint.</p> <p>The Cadw dataset of Historic Parks and Gardens has not yet been published and so land in proximity to Welsh Historic Parks and Gardens was not able to be considered.</p> <p>Although datasets for conservation areas are openly available in Wales, they were not publicly available for Shropshire at the time of assessment. Therefore, for consistency conservation areas were not treated as a constraint.</p> <p>Wind development is likely to be considered inappropriate in close proximity to all designated assets. The acceptability will vary on a site-by-site and asset-by-asset basis and also be heavily influenced by public benefit deriving from a scheme. Planning permission may be more difficult to obtain for sites close to such designated assets.</p> |
| <b>Country Parks</b>     | <p>Score 1 for land that is:</p> <ul style="list-style-type: none"> <li>Located within or within 1km of a Country Park.</li> </ul>   | <ul style="list-style-type: none"> <li>Natural England</li> </ul>                | <p>Wind development may be appropriate within or in close proximity to some country parks, however planning permission may be more difficult to obtain for sites within or close to country parks.</p>  |
| <b>Flood Zones</b>       | <p>Score 1 for land that is:</p> <ul style="list-style-type: none"> <li>Located within Flood Zone 3.</li> </ul>  | <ul style="list-style-type: none"> <li>EA</li> </ul>                             | <p>Wind development will not necessarily be unfeasible within areas of greater flood risk, however the delivery of wind development in such locations may be more complex and costly.</p>   |

| Parameter                    | Assumption   | Data source  | Justification and Notes   |
|------------------------------|--|--|---|
| <b>Agricultural Land Use</b> | <p>Score 1 for land that:</p> <ul style="list-style-type: none"> <li>Is located within agricultural land use classifications grades 1 and 2</li> </ul>   | <ul style="list-style-type: none"> <li>Natural England</li> </ul>                  | <p>Agricultural land use is a consideration, with grades 1 and 2 land having higher value for food production. Further investigation would be required of grade 3 land to determine whether it is grade 3a or 3b, as available data does not distinguish these.</p> <p>Wind energy developments have a lesser land take than ground-mounted solar, and agricultural practices can still be undertaken at wind farms. However, the turbines and infrastructure such as access tracks may limit the productivity of a site and as such may wind developments may be less deliverable on higher grade agricultural land.</p> |
| <b>Noise</b>                 | <p>Score 1 for land within:</p> <ul style="list-style-type: none"> <li>Indicative residential buffer zones based on turbine size: <ul style="list-style-type: none"> <li>Very large scale: 500m for residential/ other sensitive receptors<sup>33</sup>.</li> <li>Large scale: 480m for residential/ other sensitive receptors.</li> <li>Medium scale: 400m for residential/ other sensitive receptors.</li> <li>Small scale: 180m for residential/other sensitive receptors.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>OS OpenMap Local Buildings layer</li> </ul> | <p>As open data does not distinguish between residential and commercial use of buildings, commercial buffers were used as a primary constraint, with the aim to identify the largest area of land that is potentially suitable for development with regards to noise impacts.</p> <p>As part of the prioritisation process, residential/sensitive receptor buffers were used as secondary considerations.</p>   |

### Additional Opportunities

When assessing the deployable potential of individual land parcels for wind generation, the following additional opportunities could be considered. These opportunities were mapped separately (**Figure 3.25-Figure 3.29**), but did not form part of the main secondary opportunities mapping (**Figure 3.10, Figure 3.14, Figure 3.18 and Figure 3.22**). The reason for this being that the brownfield land datasets contain only point data that could not be accurately overlaid, the wind speed data is continuous with higher speeds having greater potential, and existing and potential ground-mounted solar co-location opportunities would require site-specific assessment to determine their suitability.

Table B - 4: Wind resource assessment additional opportunities

| Parameter   | Assumption   | Data source  | Justification and Notes  |
|---|--|--|--|
| <b>Wind Speeds</b>  | Additional opportunities for land that: <ul style="list-style-type: none"> <li>Has higher average wind speeds, considering wind speeds at different turbine heights</li> </ul> | <ul style="list-style-type: none"> <li>Global Wind Atlas/Vortex</li> </ul>   | <p>Locations with higher wind speeds are likely to have a greater generation potential and therefore are more likely to be financially viable and deliverable.</p> <p>Land parcels were prioritised differently for each turbine size category, considering wind speeds at different heights.</p> <p>This was considered separately from the combined consideration of other secondary opportunities.</p>  |
| <b>Brownfield Land</b>  | Additional opportunities for land that: <ul style="list-style-type: none"> <li>Contains brownfield land.</li> </ul>  | <ul style="list-style-type: none"> <li>Open Shropshire Council and Telford and Wrekin Brownfield Land Register points</li> </ul> | <p>Developments that re-use previously developed land are more likely to be viewed more favourably when being considered for planning permission.</p>  |
| <b>Existing Renewable Energy Developments</b>                             | Additional opportunities for land that: <ul style="list-style-type: none"> <li>Contains existing or consented ground-mounted solar developments.</li> </ul>                    | <ul style="list-style-type: none"> <li>BEIS</li> </ul>   | <p>The BEIS quarterly renewable energy database was used to determine the locations of operational and consented renewable energy installations. It was then cross-referenced with Inspire Land boundary data obtained from the Land Registry.</p> <p>Co-locating developments may make developments more deliverable, such as through reduced construction costs, use of shared infrastructure, and increased continuity of supply to compensate for intermittencies in generation during periods of lower wind speeds.</p> |
| <b>Identified areas of potential for ground-mounted solar development</b> | Additional opportunities for land that: <ul style="list-style-type: none"> <li>Contains identified land parcels for ground-mounted solar developments.</li> </ul>              | <ul style="list-style-type: none"> <li>LUC</li> </ul>  | <p>Co-locating developments may make developments more deliverable, such as through reduced construction costs, use of shared infrastructure, and increased continuity of supply to compensate for intermittencies in generation during periods of lower wind speeds.</p>  |

## Constraints considered but not used

Table B - 5: Wind resource assessment constraints considered but not used

| Parameter  | Assumption   | Data source  | Justification and Notes   |
|--|--|--|---|
| <b>NATS (National Air Traffic Services) Safeguarding Areas</b> | <p>Guidance includes reference to the following safeguarding areas:</p> <ul style="list-style-type: none"> <li>• 30km for aerodromes with a surveillance radar facility.</li> <li>• 17km for non-radar equipped aerodromes with a runway of 1,100 m or more, or 5km for those with a shorter runway.</li> <li>• 4km for non-radar equipped unlicensed aerodrome with a runway of more than 800m or 3km with a shorter runway.</li> <li>• 10km for the air-ground-air communication stations and navigation aids.</li> <li>• 15 nautical miles (nm) for secondary surveillance radar.</li> </ul> <p>These are indicative of potential constraints to wind development but cannot be used to definitively exclude land as unsuitable. They are generally presented as separate figures alongside the main assessment of technical potential.</p> | <ul style="list-style-type: none"> <li>• NATS</li> </ul> | <p>Further consultation between potential developers and NATS is required to determine if there is any impact from a proposed development.</p> <p>NATS safeguarding areas were therefore not excluded.</p>  |
| <b>Shadow Flicker</b>  | No land excluded on this basis   | <ul style="list-style-type: none"> <li>• N/A</li> </ul>  | <p>Wind turbines may in some circumstances cause 'shadow flicker' within nearby properties. However, shadow flicker effects are readily mitigated and so shadow flicker was not considered as a constraint for the purposes of this study.</p>  |
| <b>Electricity Grid (wind)</b>                                 | No land prioritised on this basis  | <ul style="list-style-type: none"> <li>• N/A</li> </ul>  | <p>Although developers commonly only pursue ground-mounted solar developments in close proximity to grid connections, due to the cost of connection over long distances in comparison to the generation income, this is less common for wind energy developments, which tend to require larger overall investments in their development, including incorporating grid connection costs.</p> |