

# Appendix 1: Wind and Ground-Mounted Solar Constraints

Table 52: Summary of high-level constraints used in the wind assessment

Constraint (areas excluded from “Less Constrained Areas”)	Comments and data sources
<p><b>Wind resource:</b> Areas with estimated wind speeds less than 6.0m/s at 45m are excluded.</p>	<p>Wind speeds greater than 6.0m/s at 45m height are considered more likely to result in a financially viable wind scheme. Met Office (no date) data providing 1.5km<sup>2</sup> resolution average wind speed data at 45m height for the period 1984-2014 was used (Welsh Government, 2015) Whilst this data source provides an indication of wind speed, the low geographic resolution and underlying assumptions means that site specific wind assessments are required to understand the energy potential and associated financial viability of individual sites. Ideally, sites for wind developments will experience wind speeds much greater than 6.0m/s at 45m height, but given the resolution of the wind data used, 6.0m/s is considered an appropriate cut-off for this high-level assessment.</p>
<p><b>Environmental/Landscape designations:</b> The following land designations are excluded:</p> <ul style="list-style-type: none"> <li>&gt; Areas of Outstanding Natural Beauty (AONB)</li> <li>&gt; Local Nature Reserves (LNRs)*</li> <li>&gt; National Nature Reserves (NNRs)</li> <li>&gt; Ramsar sites</li> <li>&gt; Special Areas of Conservation (SACs)</li> <li>&gt; Sites of Special Scientific Interest (SSSIs)</li> <li>&gt; Special Protection Areas (SPAs)</li> </ul>	<p>Whilst it may be possible to install wind turbines within designated areas, depending on the nature of the individual site and designation, for a high-level assessment, these areas are considered less suitable.</p> <p>The latest datasets available on the Welsh Government’s Geo-Portal in February 2020 (Welsh Government, 2020b) are used in the assessment.</p> <p>*Local Nature Reserves are included in the constraints list in addition to the other designations included within the Toolkit (Welsh Government, 2015) suggestions. The Toolkit states the following; “It is recognised that the above list is not exhaustive and where additional environmental and/or heritage constraints exist they should also be taken into consideration.” (Welsh Government, 2015, p. 138)</p> <p>The Brecon Beacons National Park Authority were contacted with regard to this assessment to enquire whether a specific exclusion zone should be included around the National Park. Rather than specify a specific exclusion distance the National Park Authority advised that a landscape-based approach should be taken when considering a site’s impact on the National Park. Carbon Trust consider that this approach should be taken on a site-by-site basis to ensure that the site-specific nature is considered.</p>
<p><b>Heritage designations:</b> The following land designations are excluded:</p> <ul style="list-style-type: none"> <li>&gt; Scheduled Monuments with exclusion zone of tip height plus 10% (132m)</li> <li>&gt; Registered Historic Parks and Gardens and their settings* (“Historic Landscape Areas”)</li> <li>&gt; Landscapes of Outstanding Historic Interest*</li> <li>&gt; World Heritage Sites (WHS)*</li> </ul>	<p>The latest datasets available on the Welsh Government’s Geo-Portal in February 2020 are used for Scheduled Monuments, Landscapes of Outstanding Historic Interest (historic landscape areas) and World Heritage Sites in the assessment (Welsh Government, 2020b). At the time of writing (March 2020), Cadw are preparing a statutory register of Registered Parks and Gardens which is due for completion in 2020. In preparation of the statutory register, all boundaries are being reviewed by Cadw in consultation with the owners and occupiers of the designated sites. In the absence of the statutory register Cadw has provided non-statutory data for use in the assessment (Cadw, 2020).</p> <p>* Registered Historic Parks and Gardens and their settings, Landscapes of Outstanding Historic Interest and World Heritage Sites are included in addition to Scheduled Monuments which are included within the Toolkit (Welsh Government, 2015) suggestions. The Toolkit states the following; “It is recognised that the above list is not exhaustive and where additional environmental and/or heritage constraints exist they should also be taken into consideration.” (Welsh Government, 2015, p. 138). An exclusion zone of tip height plus 10% (132m) is included around Scheduled Monuments, due to their small footprint and to provide further protection from construction.</p>
<p><b>Domestic properties:</b> An area 500m around domestic properties (based on LLPG domestic data points, and regional boundary) is excluded.</p>	<p>Whilst it may be possible to install wind turbines closer than 500m to domestic properties, Welsh Government’s (2015) suggested exclusion zone for providing protection from noise and visual impact is used for this assessment.</p> <p>Domestic properties point location data contained within the Local Land and Property Gazetteer (LLPG) for Monmouthshire, Newport, Torfaen, Blaenau Gwent and Caerphilly, is excluded and an area 500m around the regional boundary (boundary of Monmouthshire, Newport, Torfaen, Blaenau Gwent and Caerphilly) is excluded as per the Toolkit (Welsh Government, 2015) suggestion.</p>
<p><b>Other infrastructure:</b> Areas within tip height plus 10% (132m) around buildings and secondary roads are excluded. (Restricted Local Access roads are not considered)</p>	<p>Ordnance Survey Vector Map District data (Ordnance Survey, 2020c) for buildings and the Ordnance Survey Open Roads data (Ordnance Survey, 2020a) for the secondary road network are used in the assessment.</p>
<p><b>Other infrastructure:</b> Areas within tip height plus 50m (170m) around railway tracks and primary roads are excluded.</p>	<p>Vector Map District data (Ordnance Survey, 2020c) for railways and Open Roads data (Ordnance Survey, 2020a) are used in the assessment</p>
<p><b>Other environmental data:</b> Areas within 50m of woodland and water bodies are excluded.</p>	<p>Ordnance Survey Vector Map District data (Ordnance Survey, 2020c) for woodland and surface water area* and Natural Resources Wales’ (NRW) National Forestry Inventory (NFI) data (NRW, 2016) are used. An exclusion zone of 50m is included to provide further protection to ecology in both construction and operation.</p> <p>*Vector Map District Surface Water Area (identifying larger waterbodies) is used in the assessment for wind, whereas Surface Water Line data (identifying smaller waterbodies) is not. This is because the wind development will not impact the entire potential area identified and as such there is some flexibility with respect to siting both the turbine and associated infrastructure in order to not impact or be impacted by the smaller waterbodies.</p>

**Table 53: Summary of high-level constraints used in the ground mounted solar assessment**

Constraint (areas excluded from “Less Constrained Areas”)	Comments and data sources
<p><b>Slope/Aspect:</b> The following areas are excluded:</p> <ul style="list-style-type: none"> <li>&gt; Inclinations between 3-15° outside of south-west to south-east facing</li> <li>&gt; Inclinations above 15° facing all directions (Welsh Government, 2015)</li> </ul>	<p>Ordnance Survey Terrain 50 (Ordnance Survey, 2020b) data is used to determine the slope and aspect of the terrain.</p>
<p><b>Environmental/Landscape designations:</b> The following land designations are excluded:</p> <ul style="list-style-type: none"> <li>&gt; Areas of Outstanding Natural Beauty</li> <li>&gt; Local Nature Reserves*</li> <li>&gt; Marine Nature Reserves</li> <li>&gt; National Nature Reserves</li> <li>&gt; RAMSAR sites</li> <li>&gt; Special Areas of Conservation</li> <li>&gt; Sites of Special Scientific Interest</li> <li>&gt; Special Protection Areas</li> </ul>	<p>Whilst it may be possible to install solar farms within the designated areas, depending on the nature of the individual site and designation, for a high-level assessment, these areas are considered less suitable.</p> <p>The latest datasets available on the Welsh Government’s Geo-Portal in February 2020 (Welsh Government, 2020c) are used in the assessment.</p> <p>*Local Nature Reserves are included in addition to the other designations included within the Toolkit suggestions. The Toolkit states the following; <i>“It is recognised that the above list is not exhaustive and where additional environmental and/or heritage constraints exist they should also be taken into consideration.”</i> (Welsh Government, 2015, p. 138).</p> <p>The Brecon Beacons National Park Authority were contacted with regard to this assessment to enquire whether a specific exclusion zone should be included around the National Park, they confirmed that the solar constraints assessment did not require an additional exclusion zone around the National Park.</p>
<p><b>Heritage designations:</b> The following land designations are excluded:</p> <ul style="list-style-type: none"> <li>&gt; Scheduled Monuments with exclusion zone of 50m</li> <li>&gt; Registered Historic Parks and Gardens and their settings* (“Historic Landscape Areas”)</li> <li>&gt; Landscapes of Outstanding Historic Interest*</li> <li>&gt; World Heritage Sites*</li> </ul>	<p>The latest datasets available on the Welsh Government’s Geo-Portal in February 2020 are used for Scheduled Monuments, Landscapes of Outstanding Historic Interest (historic landscape areas) and World Heritage Sites in the assessment (Welsh Government, 2020c). At the time of writing, Cadw are preparing a statutory register of Registered Parks and Gardens which is due for completion in 2020. In preparation for the statutory register, all boundaries are being reviewed by Cadw in consultation with the owners and occupiers of the designated sites. In the absence of the statutory register Cadw have provided non-statutory data for use in the assessment (Cadw, 2020). *Registered Historic Parks and Gardens and their settings, Landscapes of Outstanding Historic Interest and World Heritage Sites are included in addition to Scheduled Monuments which were included within the Toolkit suggestions. The Toolkit states the following; <i>“It is recognised that the above list is not exhaustive and where additional environmental and/or heritage constraints exist they should also be taken into consideration.”</i> (Welsh Government, 2015, p. 138).</p> <p>An exclusion zone of 50m is included around Scheduled Monuments, due to their small footprint and to provide further protection from construction.</p>
<p><b>Infrastructure/Environmental constraints:</b> The following areas are excluded:</p> <ul style="list-style-type: none"> <li>&gt; Areas within 10m of railway tracks</li> <li>&gt; Areas within 10m of primary/secondary road network</li> <li>&gt; Areas within 10m of buildings</li> <li>&gt; Areas within 10m of water bodies</li> <li>&gt; Areas within 10m of woodland</li> </ul>	<p>Ordnance Survey Open Roads data (Ordnance Survey, 2020a), Vector Map District data* (Ordnance Survey, 2020c) and NFI data (NRW, 2016) is used. A 10 m exclusion zone is applied to all features as the factor used to translate the land area available into a MW solar PV capacity assumes that the full footprint is used. In reality the areas identified will include areas that will not be suitable for PV modules – for example hedgerows, but the assessment provides a high-level indicative potential capacity.</p> <p>*Vector Map District Surface Water Area (larger waterbodies) and Line (smaller waterbodies) data is used in the assessment for solar PV, whereas just the Surface Water Area data is used in the assessment for wind. Solar developments have a greater footprint and therefore less flexibility with respect to siting, and inclusion of the surface water line data allows at a high level further break down of the potential sites. As solar equipment is much more at ground level, there is also greater importance than in the wind assessment to account for presence of waterbodies given the potential risks posed in both construction and operation.</p>

## Appendix 2: Waste Data

Table 54: TCBC current waste management processes

Waste stream	Current quantity (tonnes p.a.) based on 2018-19	Anticipated quantity in 2033 (tonnes p.a.)	Current waste destination	Current waste management process	Current waste management contract end date (year)	Anticipated waste destination in 2033	Anticipated waste management process in 2033
<b>Residual Waste</b>	20,317	14,036	Trident Park, Cardiff	Energy from Waste	Mar-42	Trident Park, Cardiff	Energy from Waste
<b>Food Waste</b>	2,715	4,609	Severn Trent, Stormy Down, Porthcawl, Bridgend CF33 4RS	Anaerobic Digestion	01/03/2033 option to extend for another 5 years.	TBC	Anaerobic Digestion
<b>Garden Waste</b>	5,081	5,081	Cowbridge Compost, Cowbridge, Vale of Glamorgan, CF71 7FF	Composting	March 2021 Option to extend for another 3 years.	TBC	Composting

## Appendix 3: Use of Local Land and Property Gazetteer Data

Data contained within the Local Land and Property Gazetteer (LLPG) has been used to inform several parts of this assessment, as detailed in Table 55.

**Table 55: Summary of LLPG data use within Renewable and Low Carbon Energy Assessment**

Assessment section	How the data was used
Section 2	The energy demand of the entire county borough is reduced to the ratio of commercial data points (except those detailed in Table 56) and residential datapoints (except those detailed in Table 57) in the study area in comparison to the county borough as a whole, to estimate the energy demand of the study area.
Section 3	The capacity of biomass (heat), solar PV (rooftop) and heat pumps in the entire county is reduced to the ratio of commercial datapoints (except those detailed in Table 56) and residential datapoints (except those detailed in Table 57) in the study area in comparison to the county as a whole, to estimate the capacities of the study area.
Section 4	The location of residential datapoints (except those detailed in Table 57) is used in GIS with a 500m exclusion zone applied, to provide the domestic property constraint for the wind resource assessment.
Section 5	The commercial and residential datapoints present within the study area (except those detailed in Tables 56 and 57) are assumed to represent the current number of commercial and residential buildings and inform the heat pump and roof-top PV assessment. The location of the datapoints is used with information relating to gas network extent at the Lower Super Output Area level to estimate the number of properties off the gas network and inform the heat pump assessment.
Section 6	The locations of commercial properties (except those detailed in Table 56) are used to inform the location of the identified anchor heat loads, and identify the number of other commercial properties in close proximity to the anchor heat loads.

Before use, the data was reviewed and any duplicates were removed. Commercial properties were identified from the primary Basic Land and Property Unit (BLPU) class “C: Commercial”, residential properties were identified from the primary BLPU class “R: Residential”. The full BLPU classes contained within these primary classifications were reviewed. Commercial data entries that were not considered to have a specific heat load or building associated with them were removed; the BLPU classes which relate to this are provided in Table 57. Residential data entries that were identified as non-dwellings were also removed; Table 58 provides the BLPU classes identified.

**Table 56: Commercial BLPU classes removed from the dataset**

<b>BLPU code</b>	<b>BLPU description</b>	<b>BLPU code</b>	<b>BLPU description</b>
CR11	Commercial, Retail, Automated Teller Machines (ATMs)	CU	Commercial, Utilities
CS	Commercial, Storage land	CU01	Commercial, Utilities, Electricity sub-stations
CS01	Commercial, Storage land, General storage land	CU02	Commercial, Utilities, Landfill
CS02	Commercial, Storage land, Builders' yards	CU03	Commercial, Utilities, Power stations/energy production
CT	Commercial, Transport	CU04	Commercial, Utilities, Pumping Stations/Water Towers
CT01	Commercial, Transport, Airports	CU06	Commercial, Utilities, Telecommunications masts
CT02	Commercial, Transport, Bus shelters	CU07	Commercial, Utilities, Water/sewage treatment works
CT03	Commercial, Transport, Car parks	CU08	Commercial, Utilities, Gas and Oil Storage and Distribution
CT04	Commercial, Transport, Goods freight handling	CU09	Commercial, Utilities, Other utility use
CT06	Commercial, Transport, Moorings	CU10	Commercial, Utilities, Waste management
CT07	Commercial, Transport, Railway assets	CU11	Commercial, Utilities, Telephone boxes
CT08	Commercial, Transport, Stations and interchanges	CZ	Commercial, Information
CT09	Commercial, Transport, Transport tracks and ways	CZ01	Commercial, Information, Advertising Hoardings
CT10	Commercial, Transport, Vehicle storage	CZ02	Commercial, Information, Tourist Information
CT11	Commercial, Transport, Transport Related Infrastructure	CZ03	Commercial, Information, Traffic Information Signage
CT13	Commercial, Transport, Harbours, ports, docks, slipways, landing stages and piers		

**Table 57: Residential BLPU classes removed from the dataset**

<b>BLPU code</b>	<b>BLPU description</b>
RB	Residential, Ancillary Buildings
RC	Residential, Car Park Space
RC01	Residential, Car Park Space, Allocated Parking
RG	Residential, Garages
RG02	Residential, Garages, Lock-Up Garages and Garage Courts

Section 5 of the assessment separates the residential properties into terraced, flats and other residential dwellings. Table 58 shows how the BLPU classes were grouped into these categories.

**Table 58: BLPUs class groupings for Buildings Integrated Renewables (BIR) assessment**

<b>Dwelling category for BIR assessment</b>	<b>BLPU class</b>	<b>BLPU description</b>
Other residential dwellings	R	Residential
	RD	Residential, Dwellings
	RD01	Residential, Dwellings, Caravans
	RD02	Residential, Dwellings, Detached
	RD03	Residential, Dwellings, Semi-Detached
	RD07	Residential, Dwellings, House Boats
	RD10	Residential, Dwellings, Privately owned holiday caravan/ chalet
Terraced properties	RD04	Residential, Dwellings, Terraced House
	RH	Residential, Houses in Multiple Occupation
	RH01	Residential, House in Multiple Occupation, HMO Parent
	RH02	Residential, House in Multiple Occupation, HMO Bedsit / Other Non Self Contained Accommodation
	RH03	Residential, House in Multiple Occupation, HMO not further divided
Flats	RD06	Residential, Dwellings, Flat
	RD08	Residential, Dwellings, Sheltered Accommodation
	RI	Residential, Residential Institutions
	RI01	Residential, Residential Institutions, Care / Nursing Home
	RI02	Residential, Residential Institutions, Communal residences
	RI03	Residential, Residential Institutions, Residential education (e.g. halls of residence)

## Appendix 4: Figures

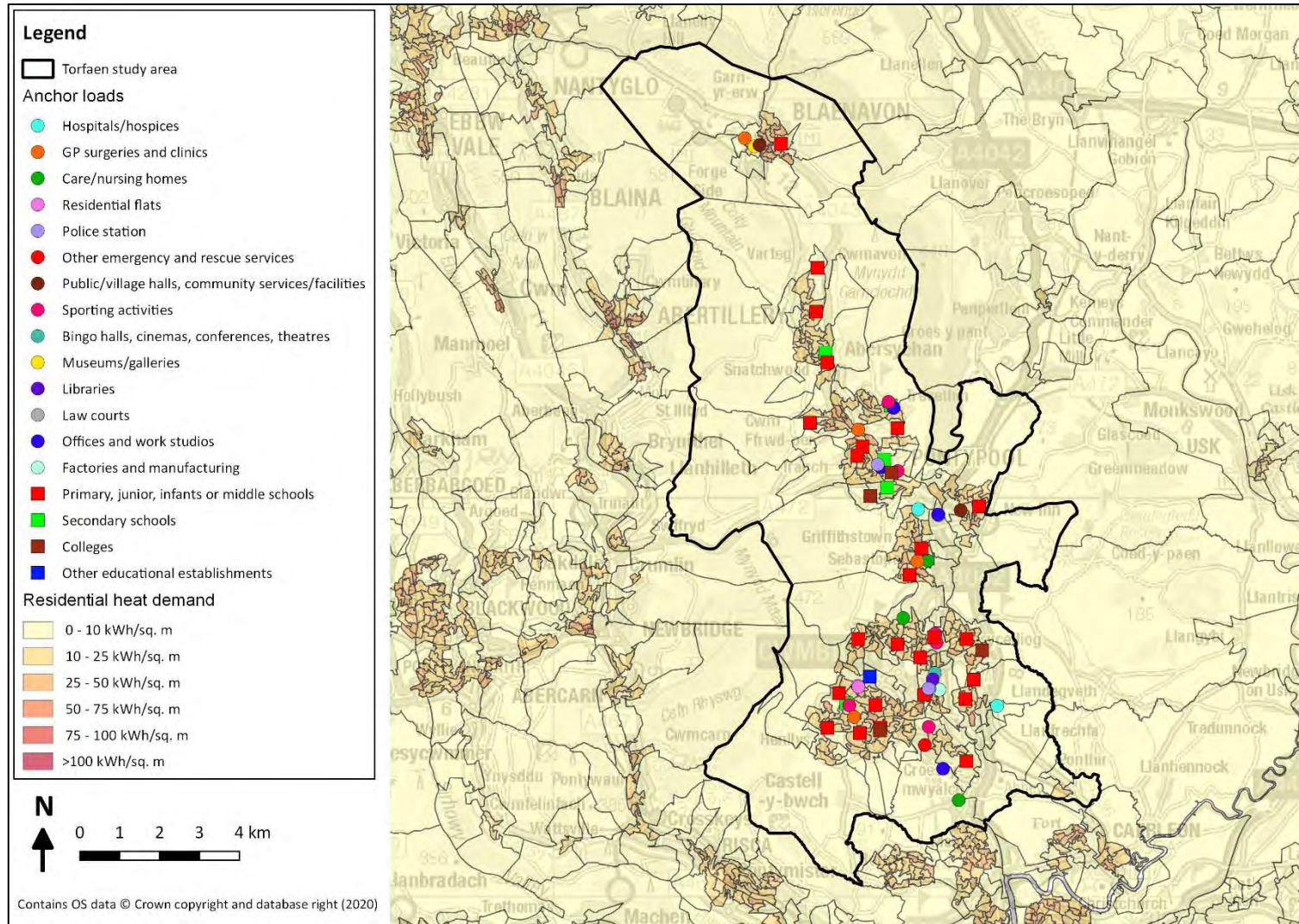


Figure 50: Anchor heat loads and residential heat demand

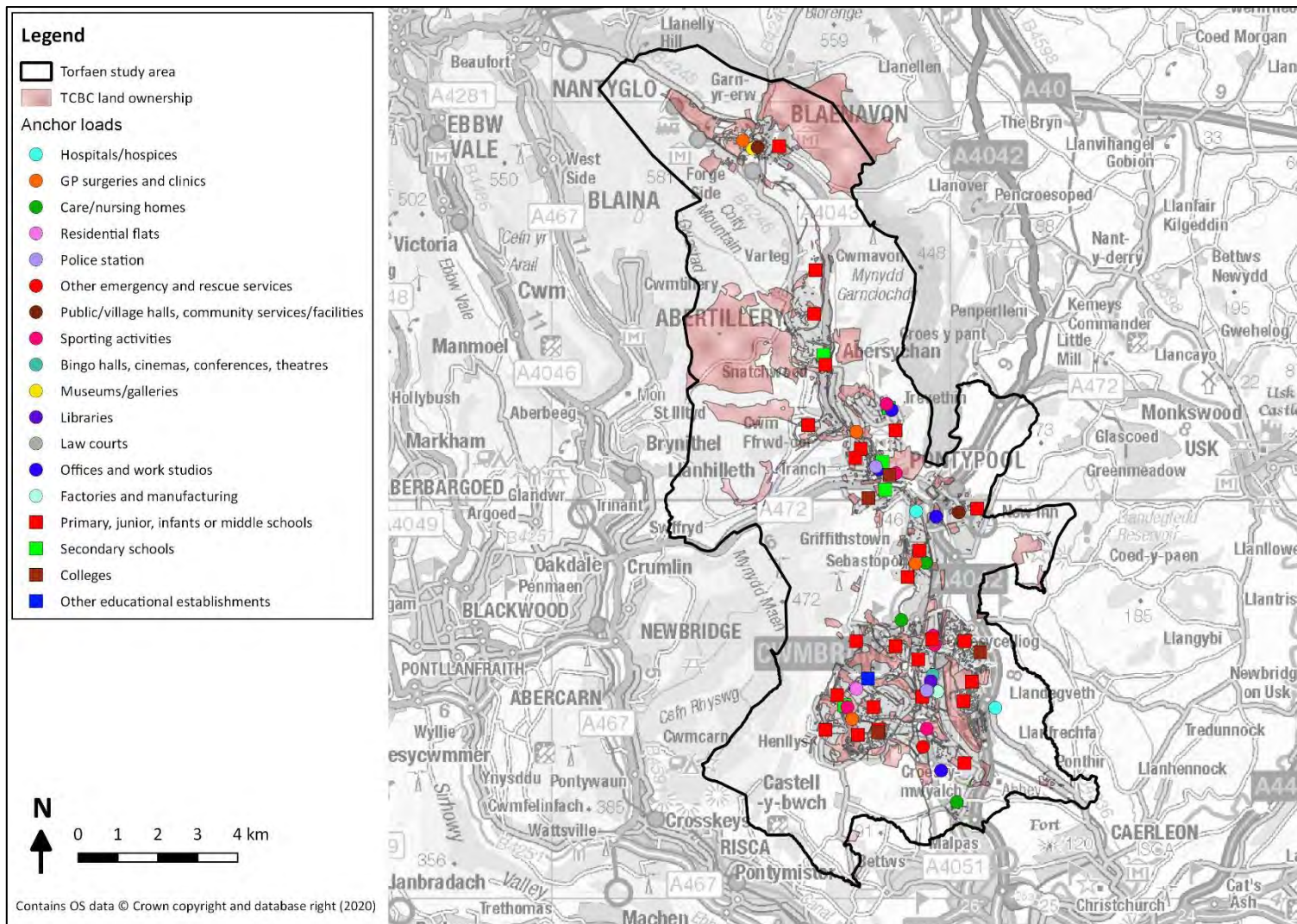


Figure 51: Anchor heat loads and local authority owned land



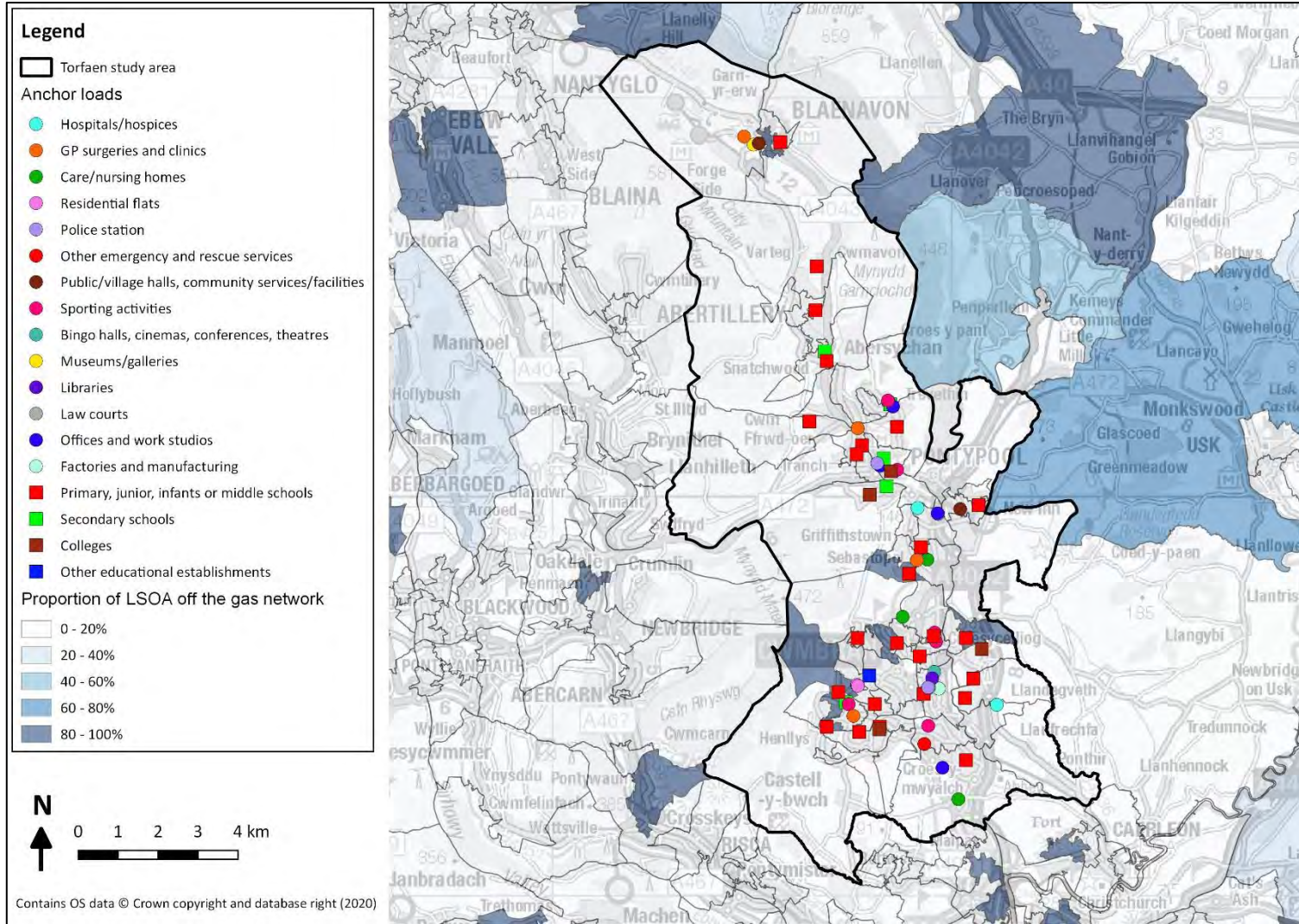


Figure 52: Anchor heat loads and gas network coverage

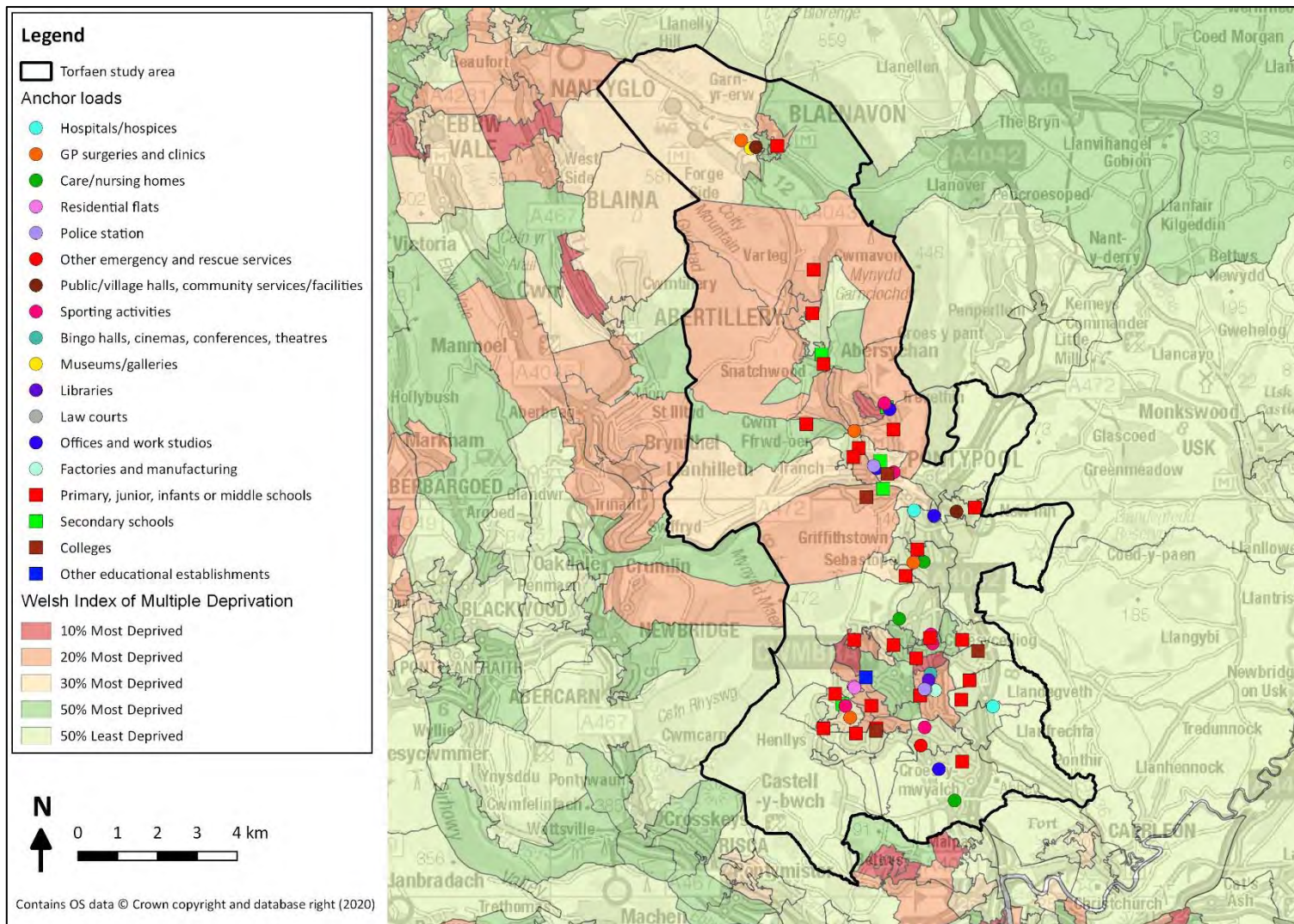


Figure 53: Anchor heat loads and the Wales Index of Multiple Deprivation

(Welsh Government, 2020b)

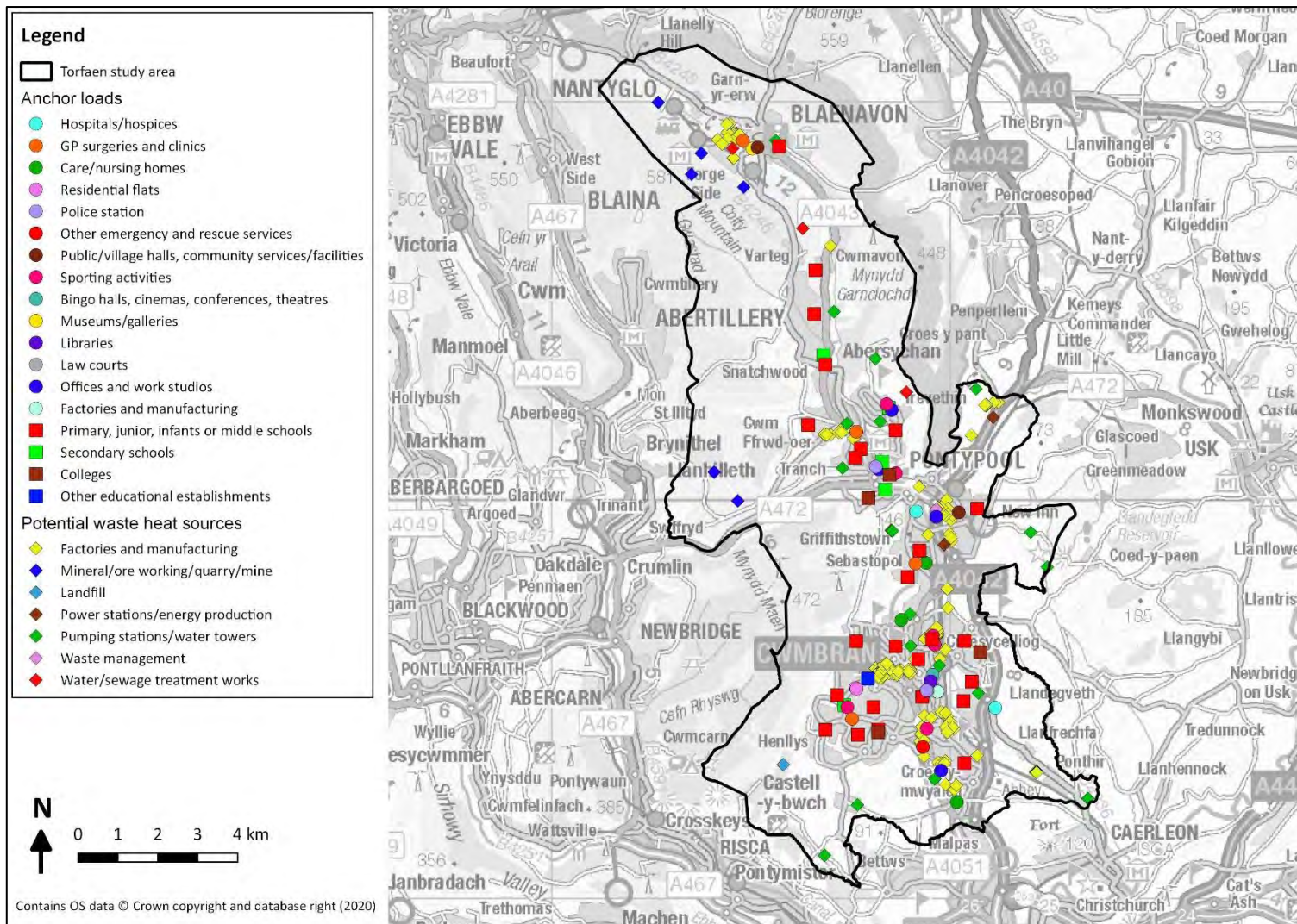


Figure 54: Anchor heat loads and potential sources of waste heat and existing heat sources

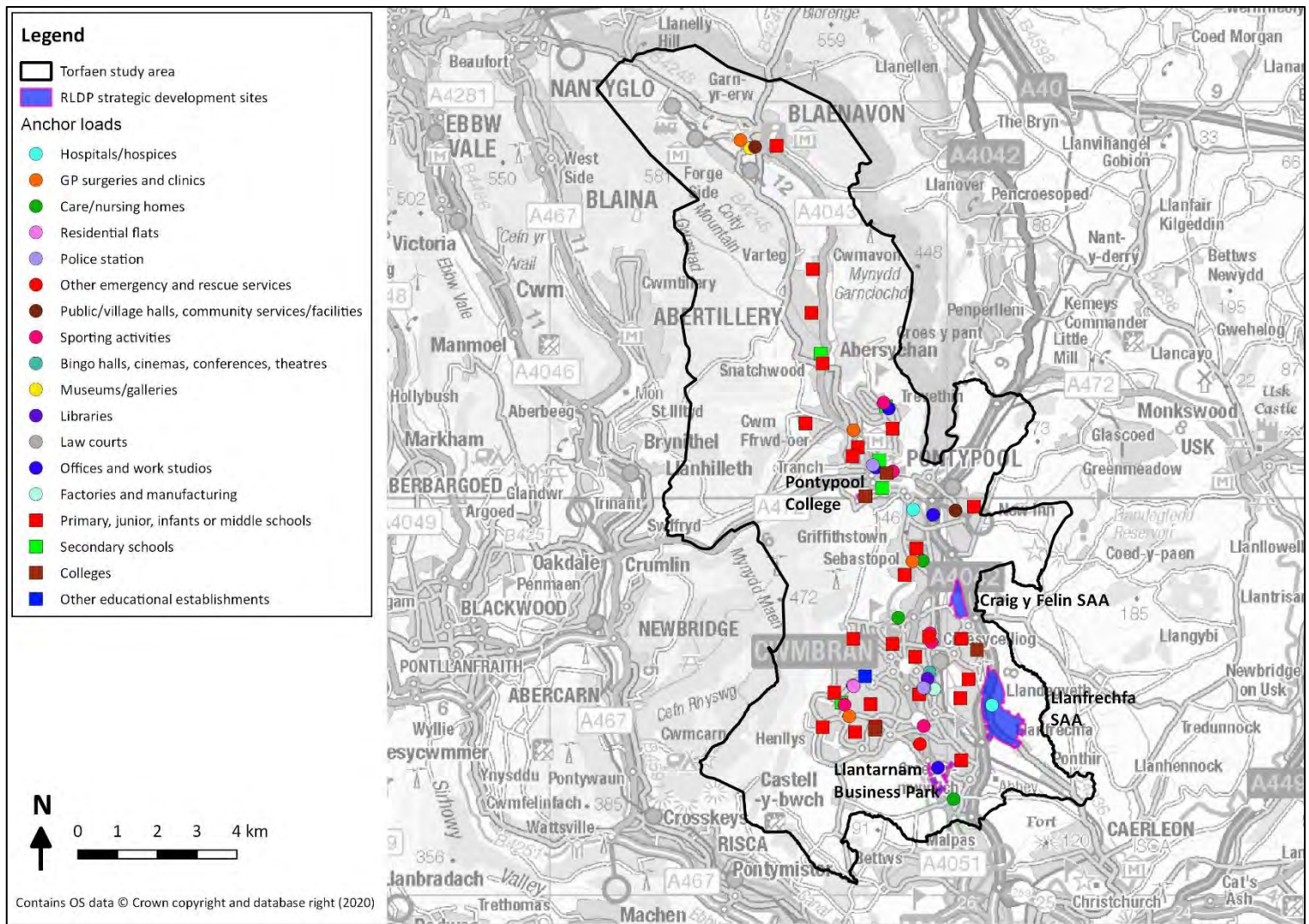


Figure 55: Anchor heat loads and RLD strategic development sites

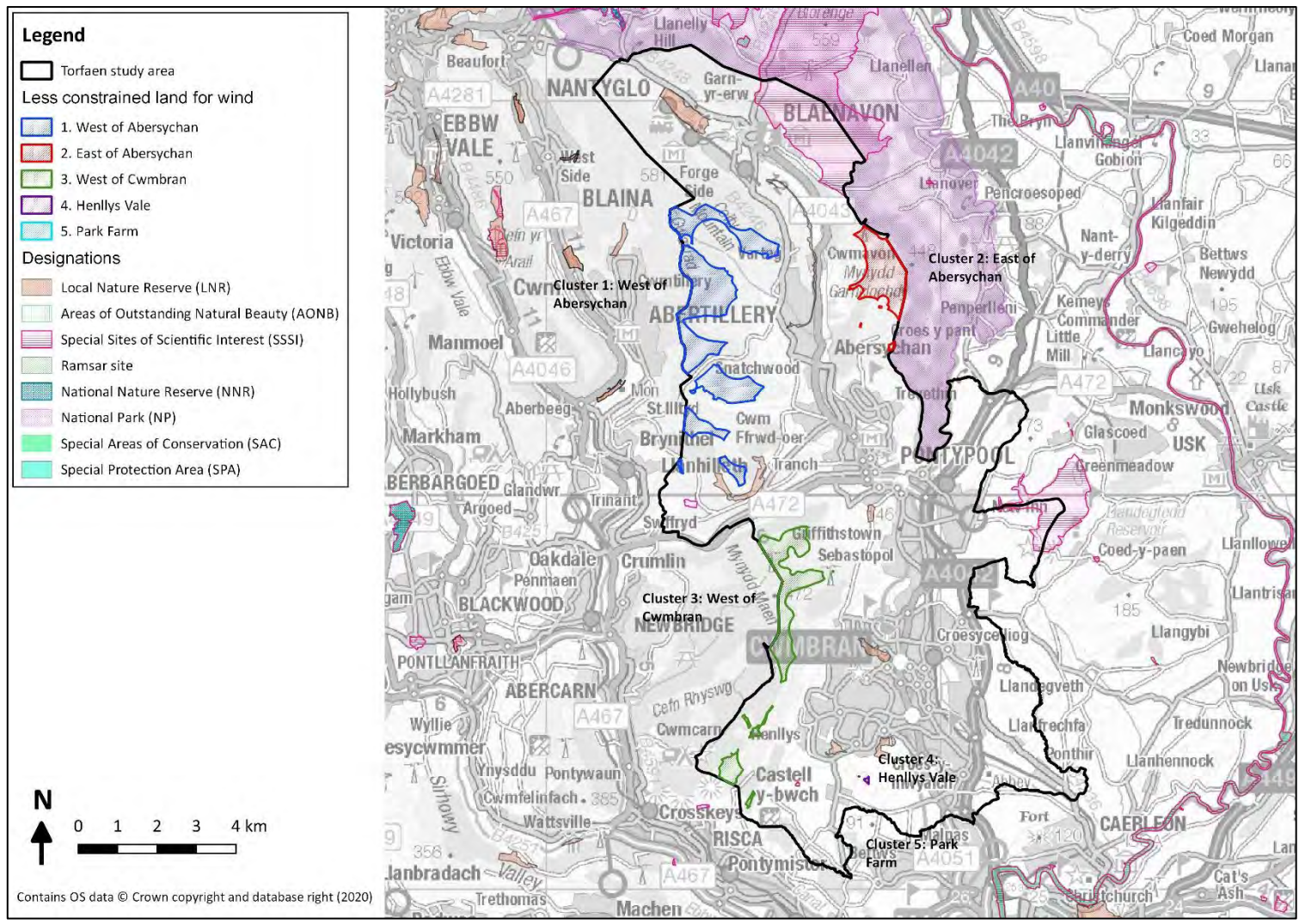


Figure 56: Less constrained land for wind (refined) and landscape designations

(Welsh Government, 2020b)

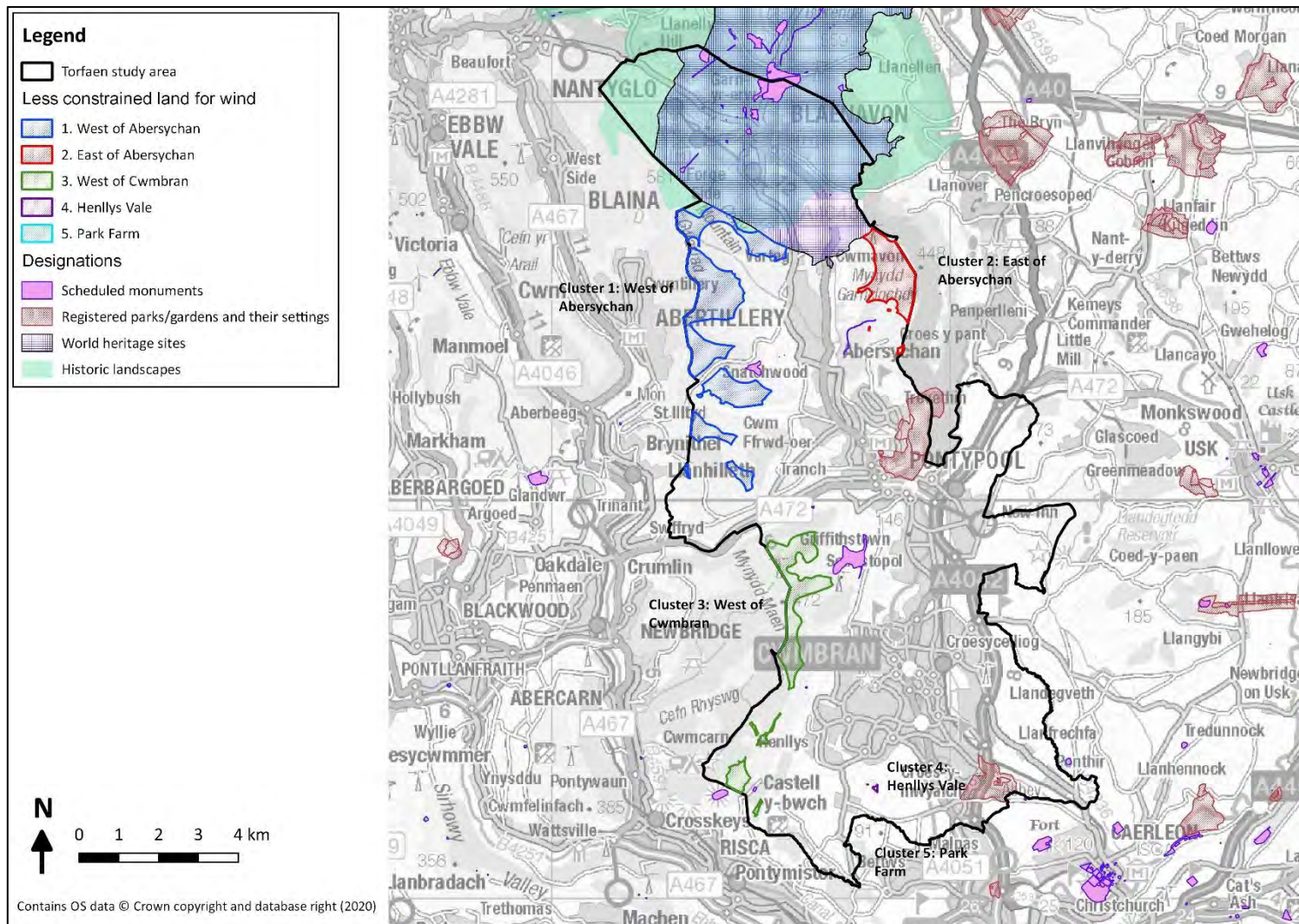


Figure 57: Less constrained land for wind (refined) and historic designations

(Welsh Government, 2020b, Cadw, 2020)

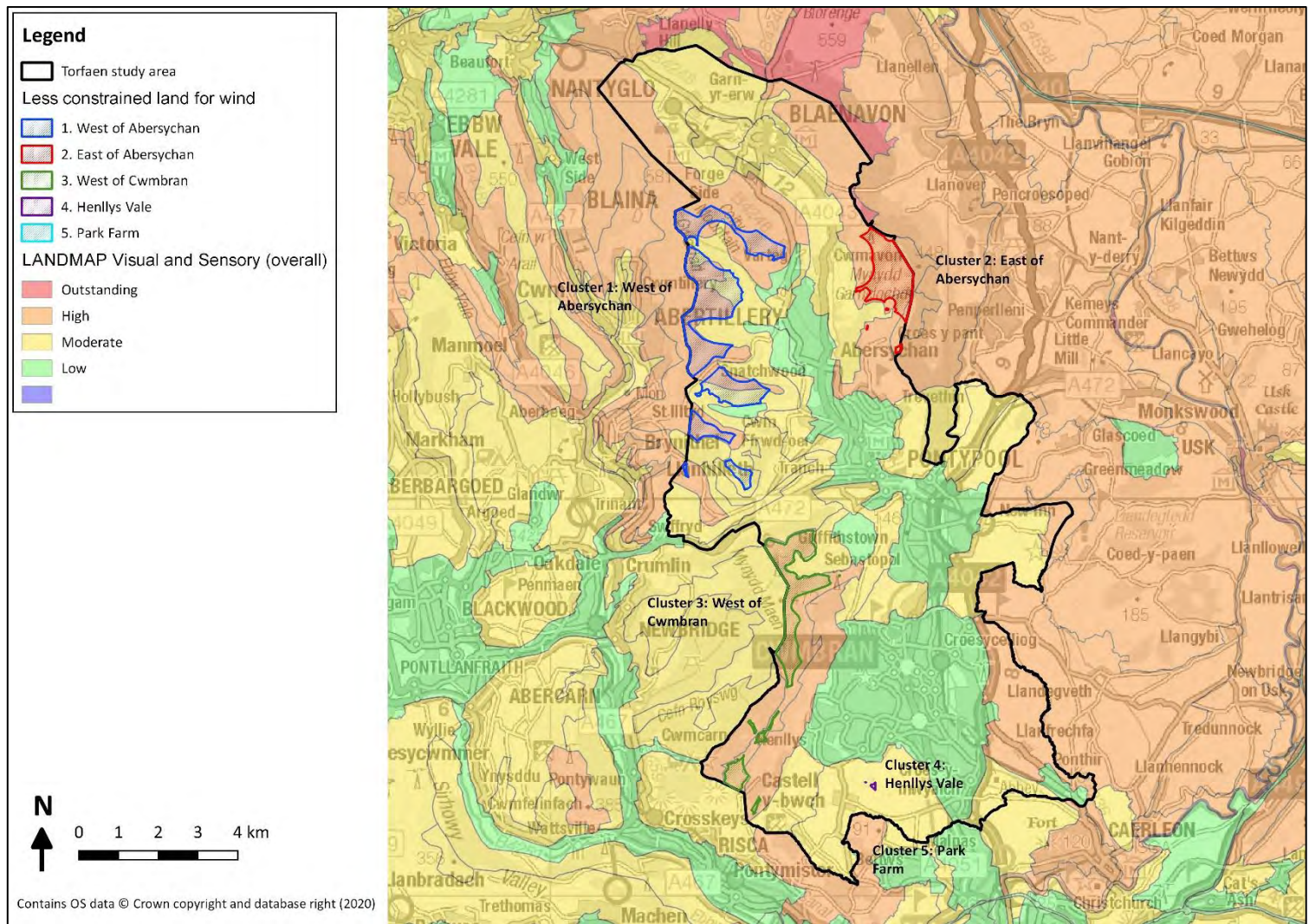


Figure 58: Less constrained land for wind (refined) and LANDMAP visual and sensory overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

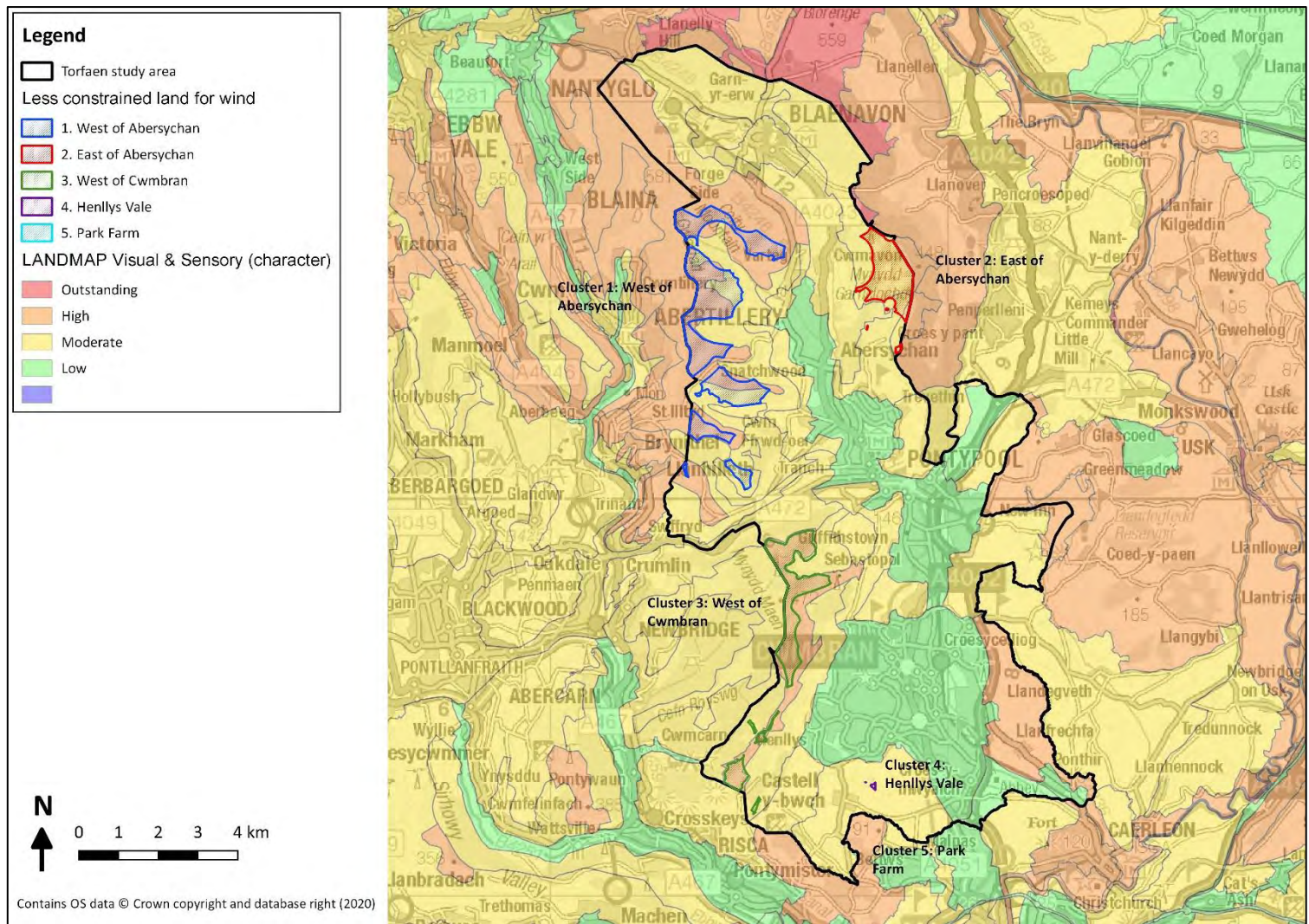


Figure 59: Less constrained land for wind (refined) and LANDMAP visual and sensory character rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)



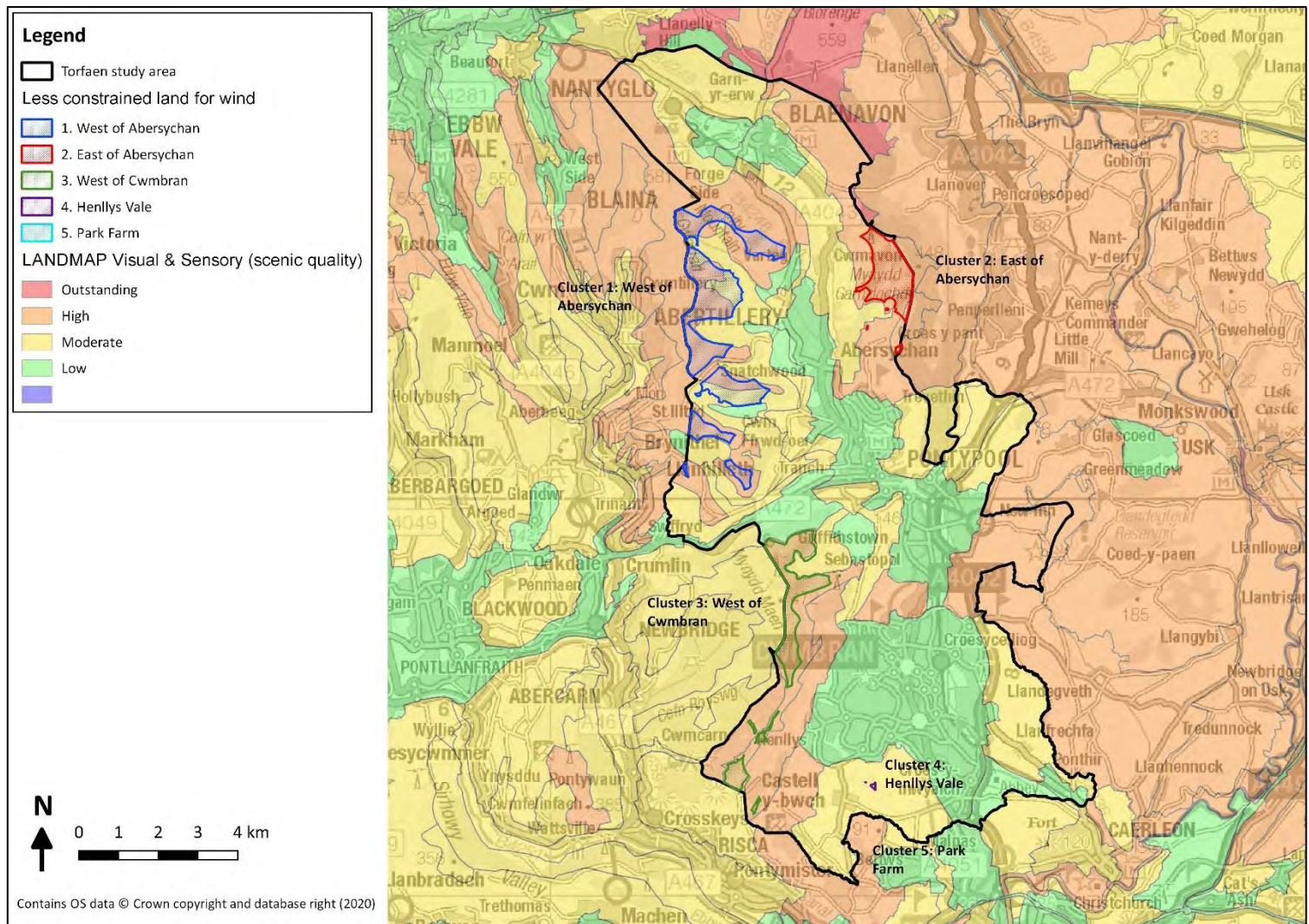


Figure 60: Less constrained land for wind (refined) and LANDMAP visual and sensory scenic quality rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

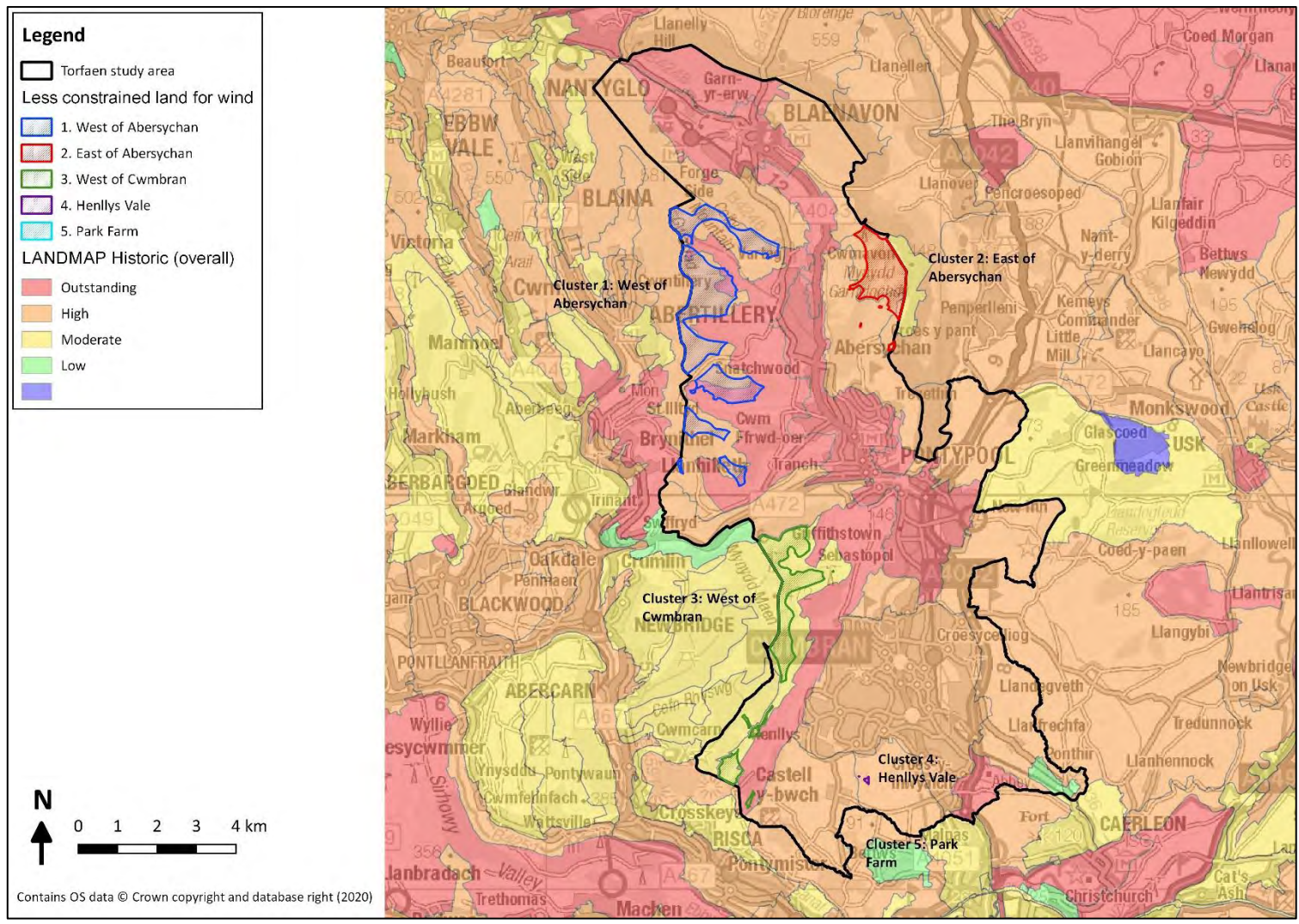


Figure 61: Less constrained land for wind (refined) and LANDMAP historic overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

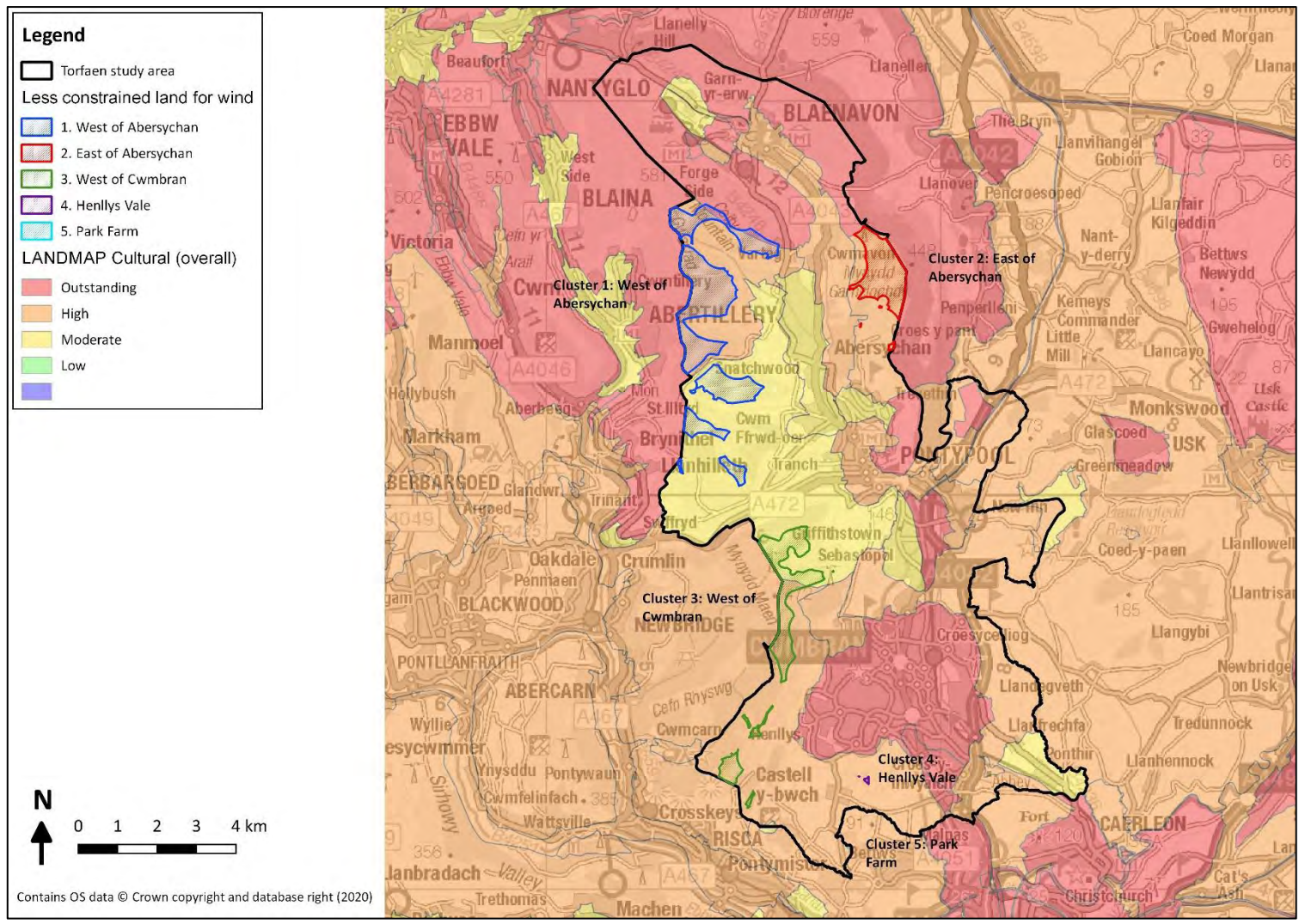


Figure 62: Less constrained land for wind (refined) and LANDMAP cultural overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

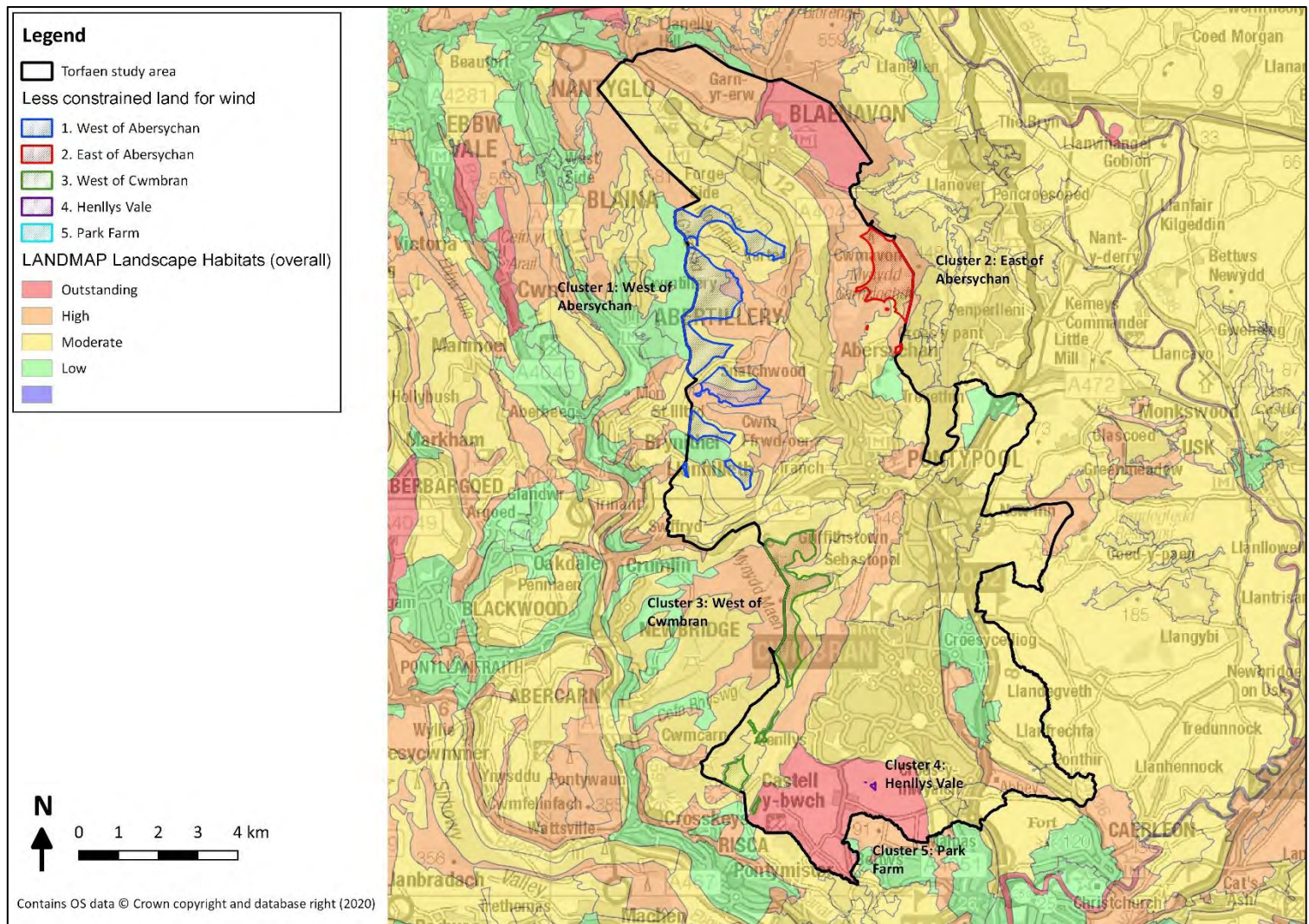


Figure 63: Less constrained land for wind (refined) and LANDMAP landscape habitats overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

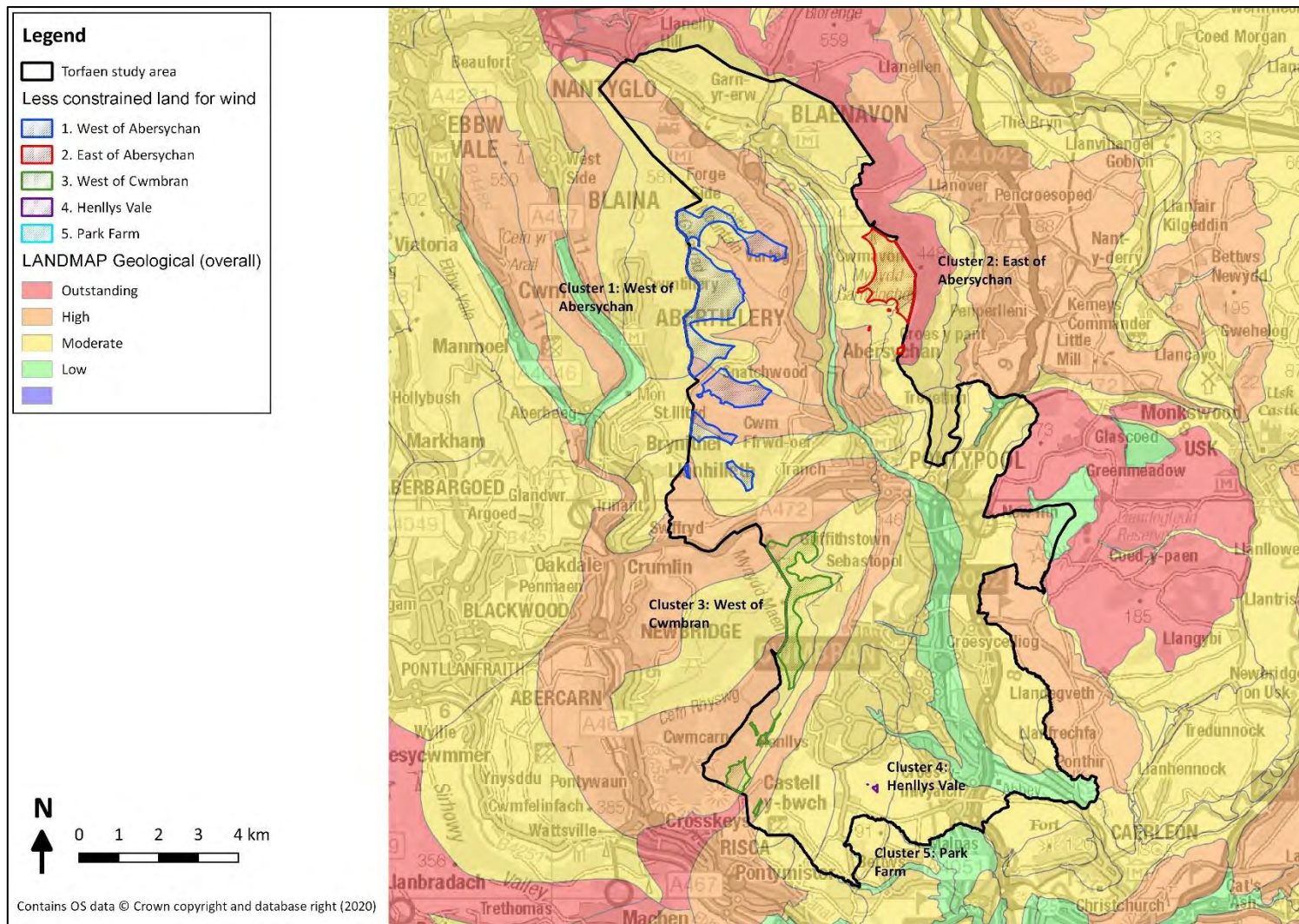


Figure 64: Less constrained land for wind (refined) and LANDMAP geological overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

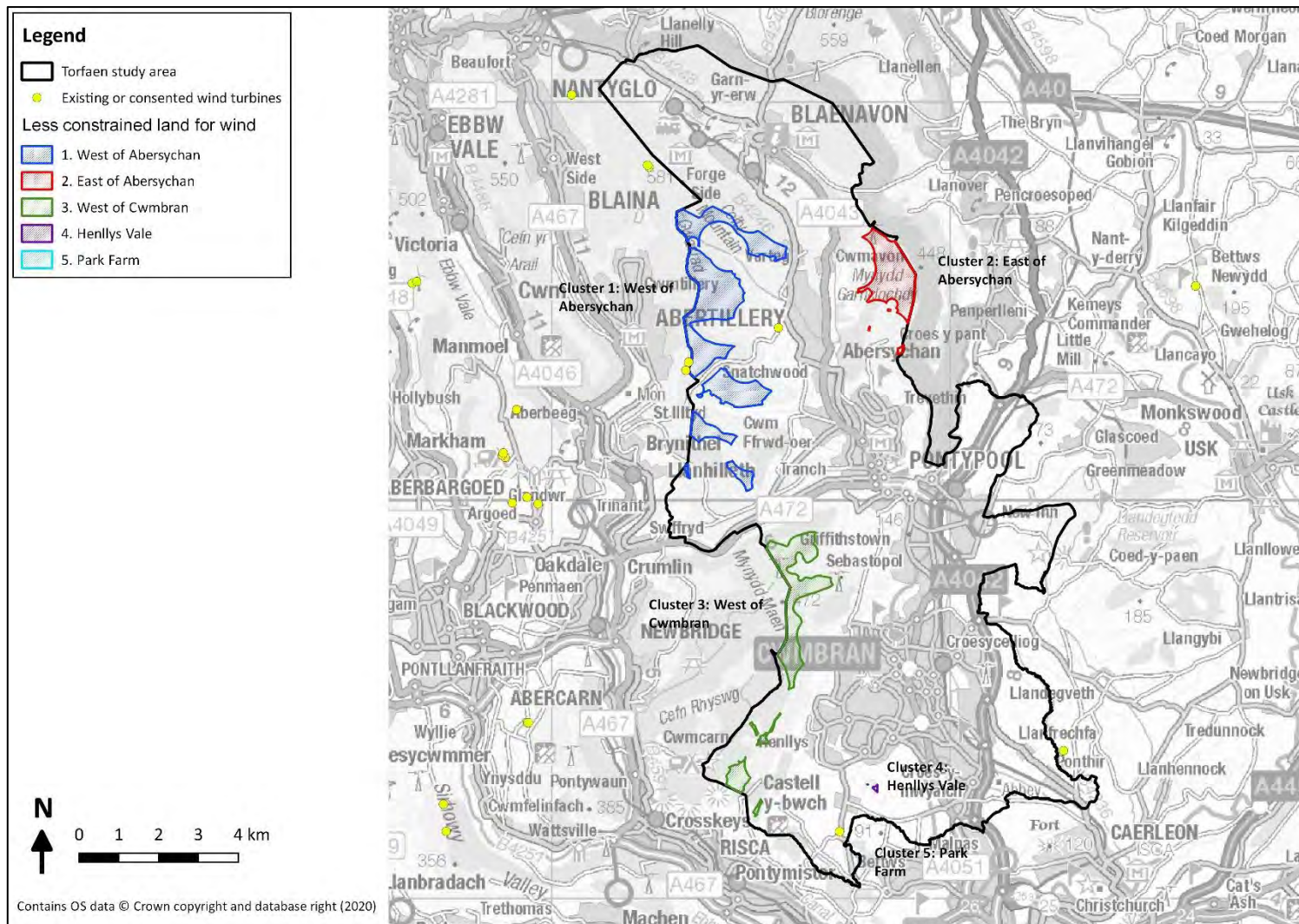


Figure 65: Less constrained land for wind (refined) and existing wind developments

(BGCBC, 2019)

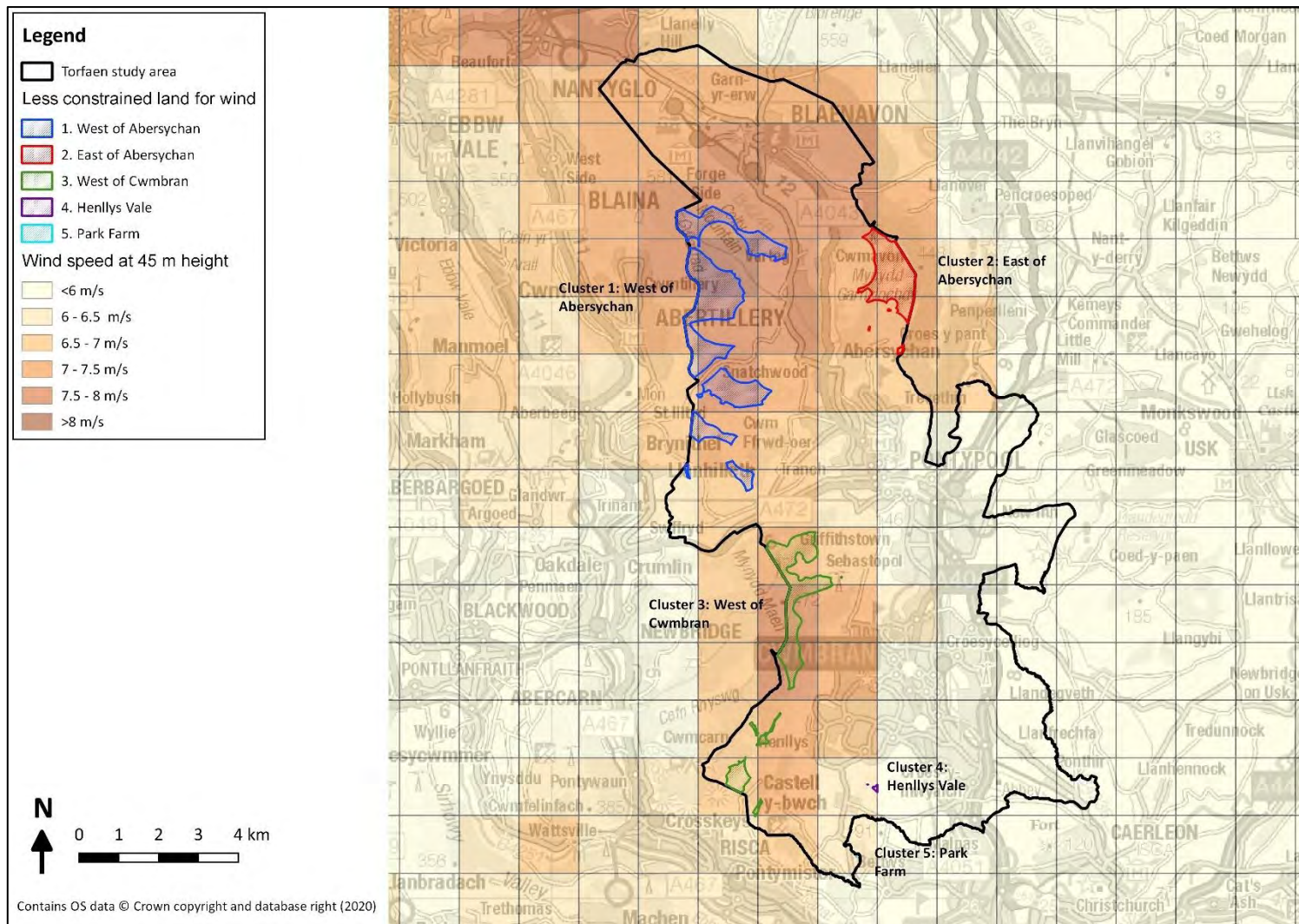


Figure 66: Less constrained land for wind (refined) and wind speed

(Met Office, no date)

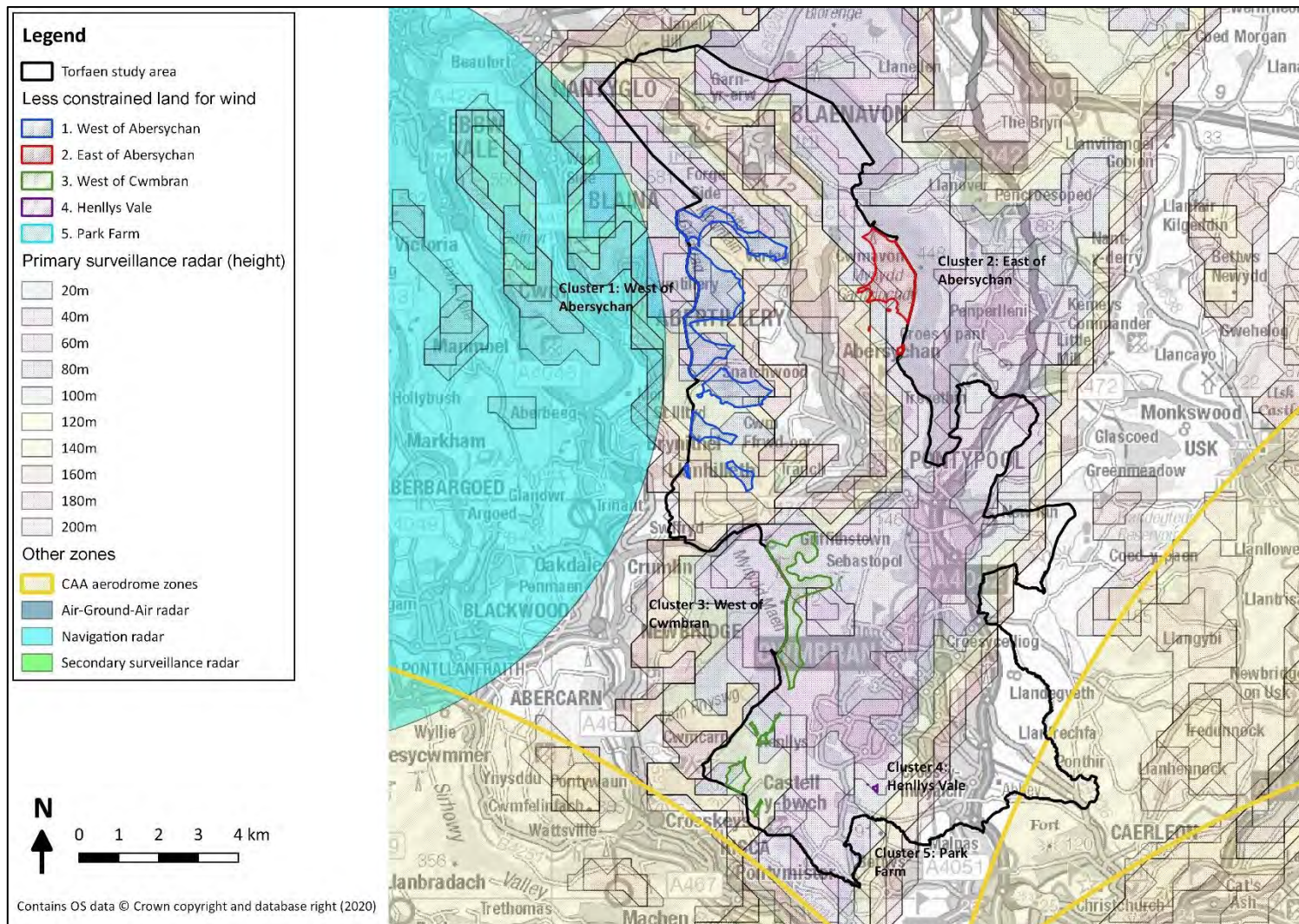


Figure 67: Less constrained land for wind (refined) and aviation zones

(CAA, 2014, NATS, no date)



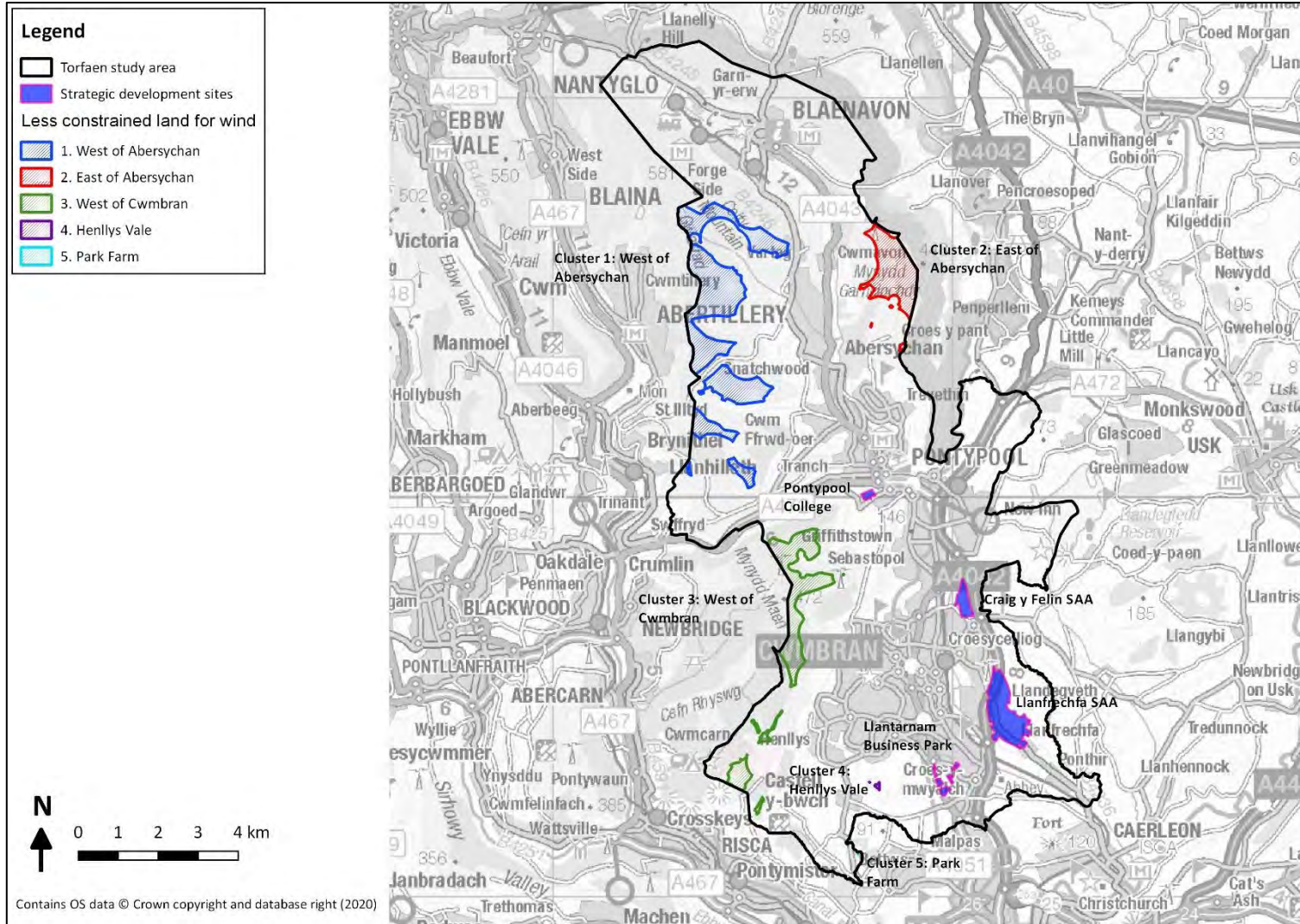


Figure 68: Less constrained land for wind (refined) and RLDP strategic development sites

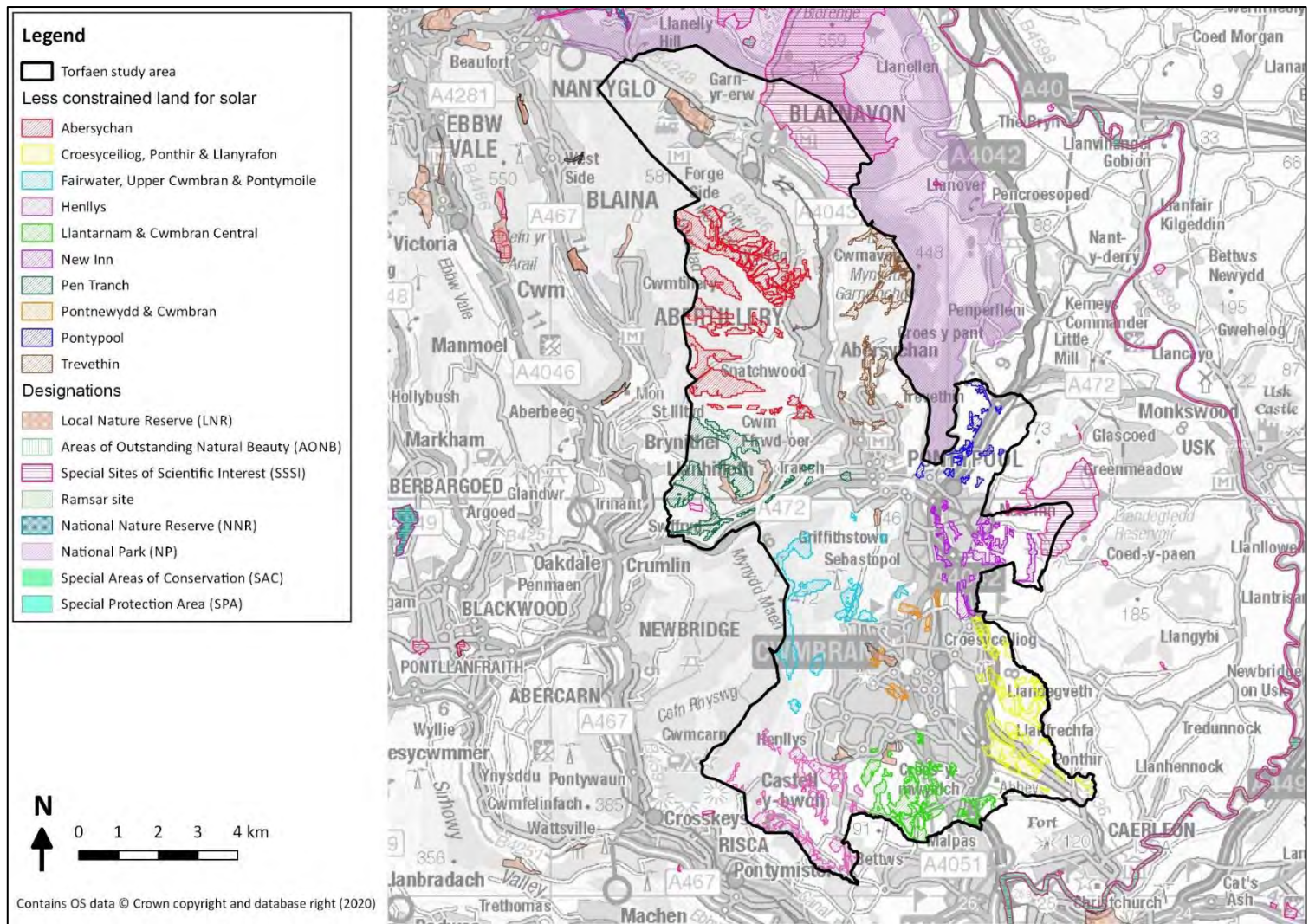


Figure 69: Less constrained land for solar (refined) and landscape designations

(Welsh Government, 2020b)

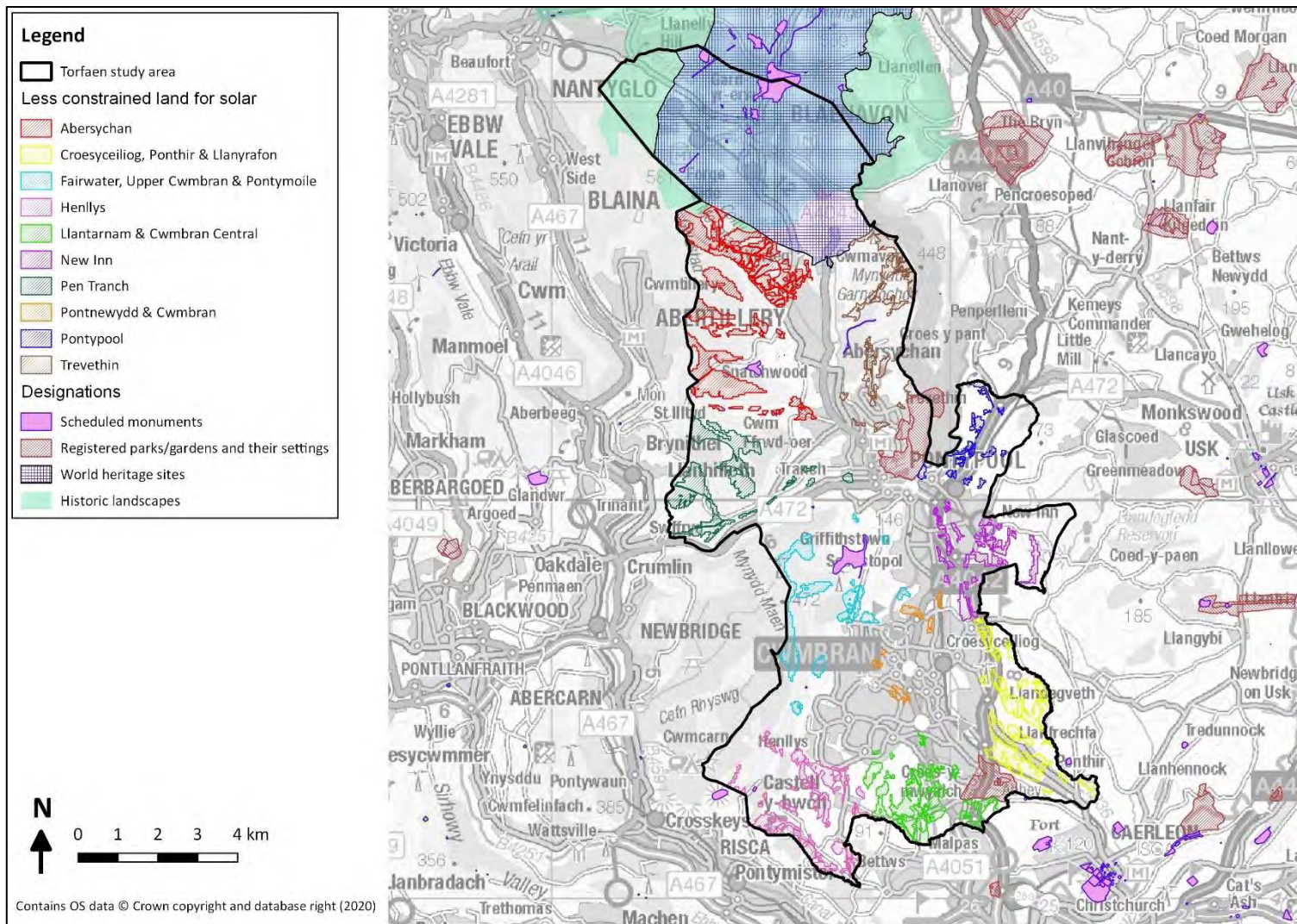


Figure 70: Less constrained land for solar (refined) and historic designations

(Welsh Government, 2020b, Cadw, 2020)

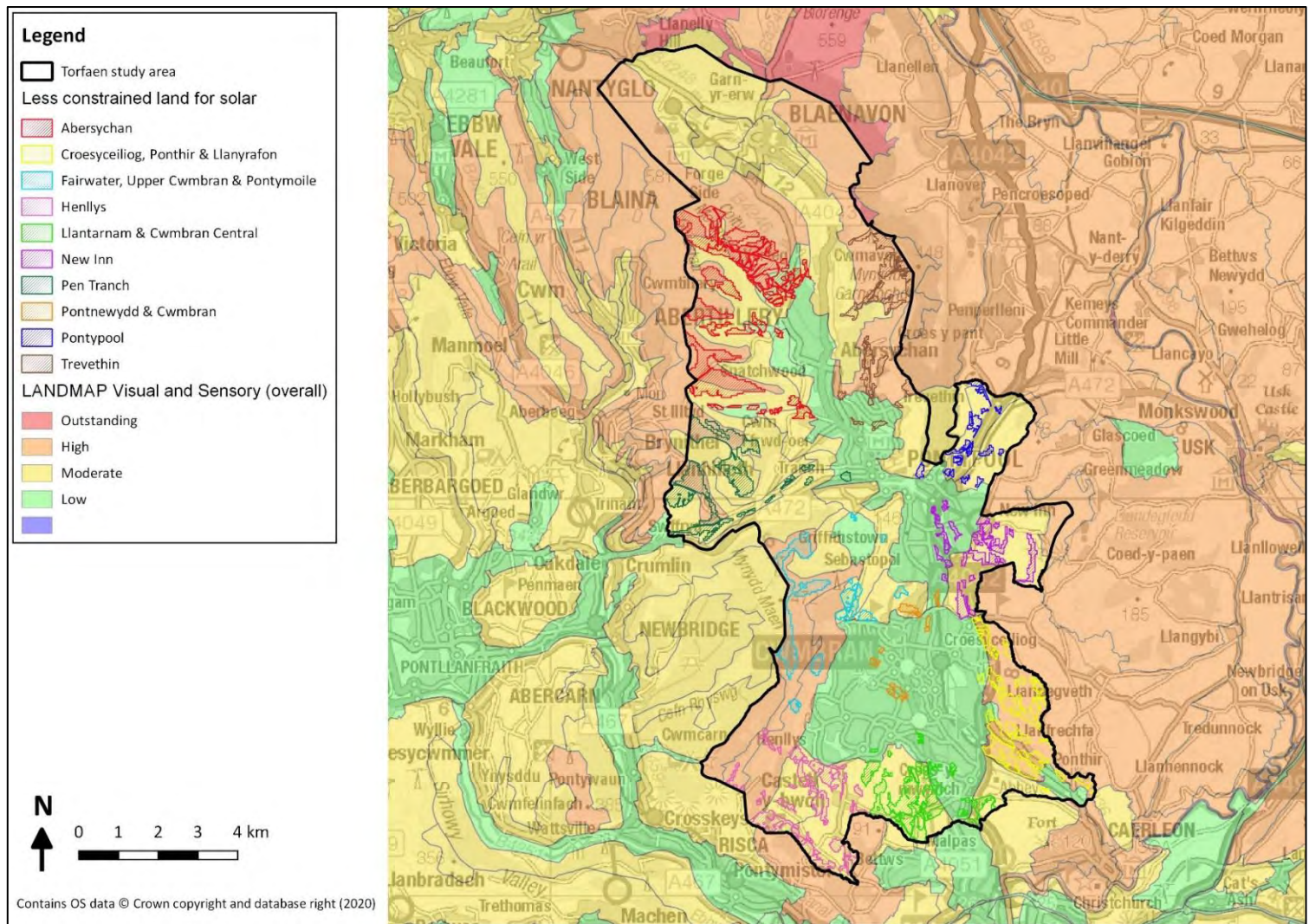


Figure 71: Less constrained land for solar (refined) and LANDMAP visual and sensory overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

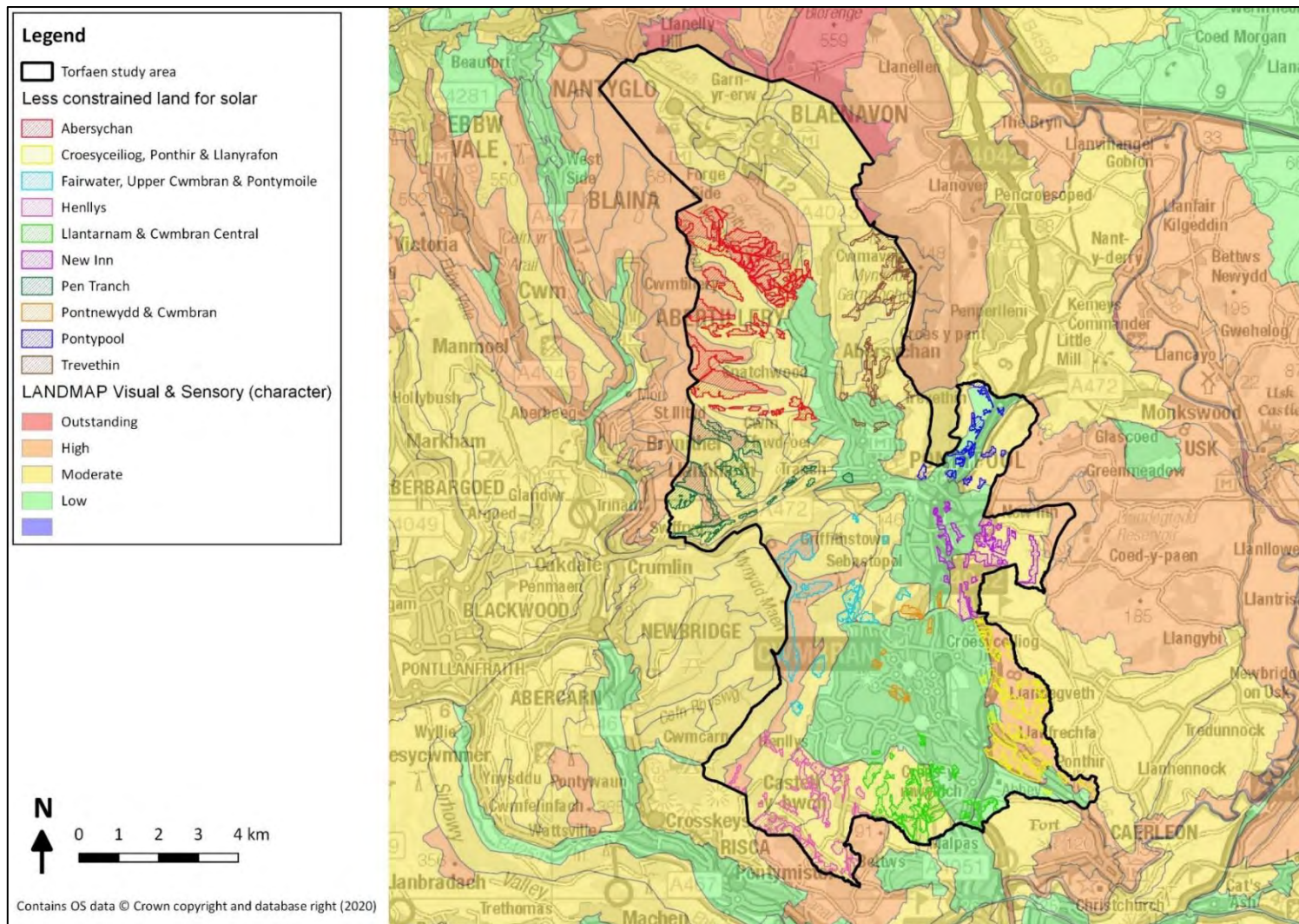


Figure 72: Less constrained land for solar (refined) and LANDMAP visual and sensory character rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

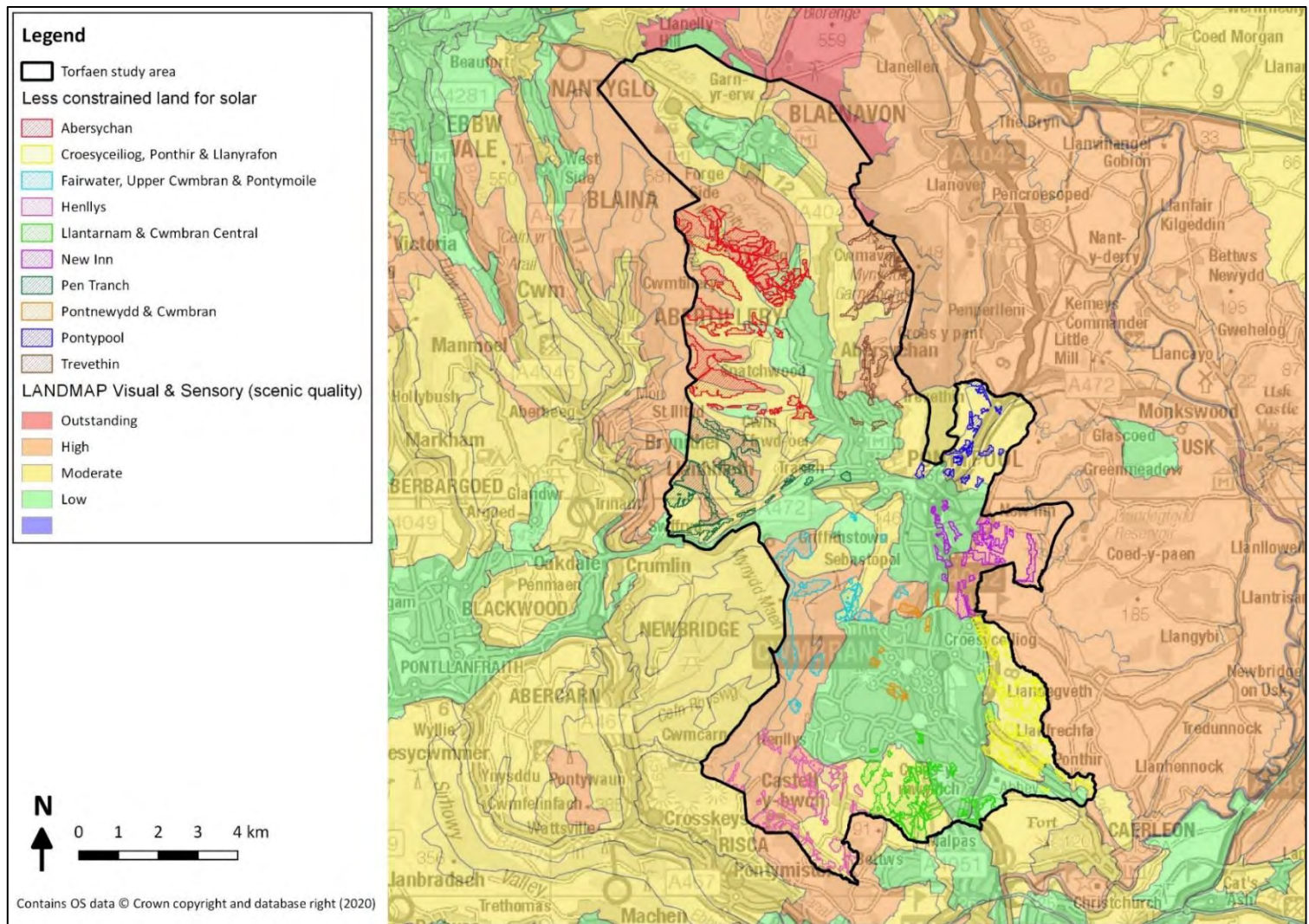


Figure 73: Less constrained land for solar (refined) and LANDMAP visual and sensory scenic quality rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

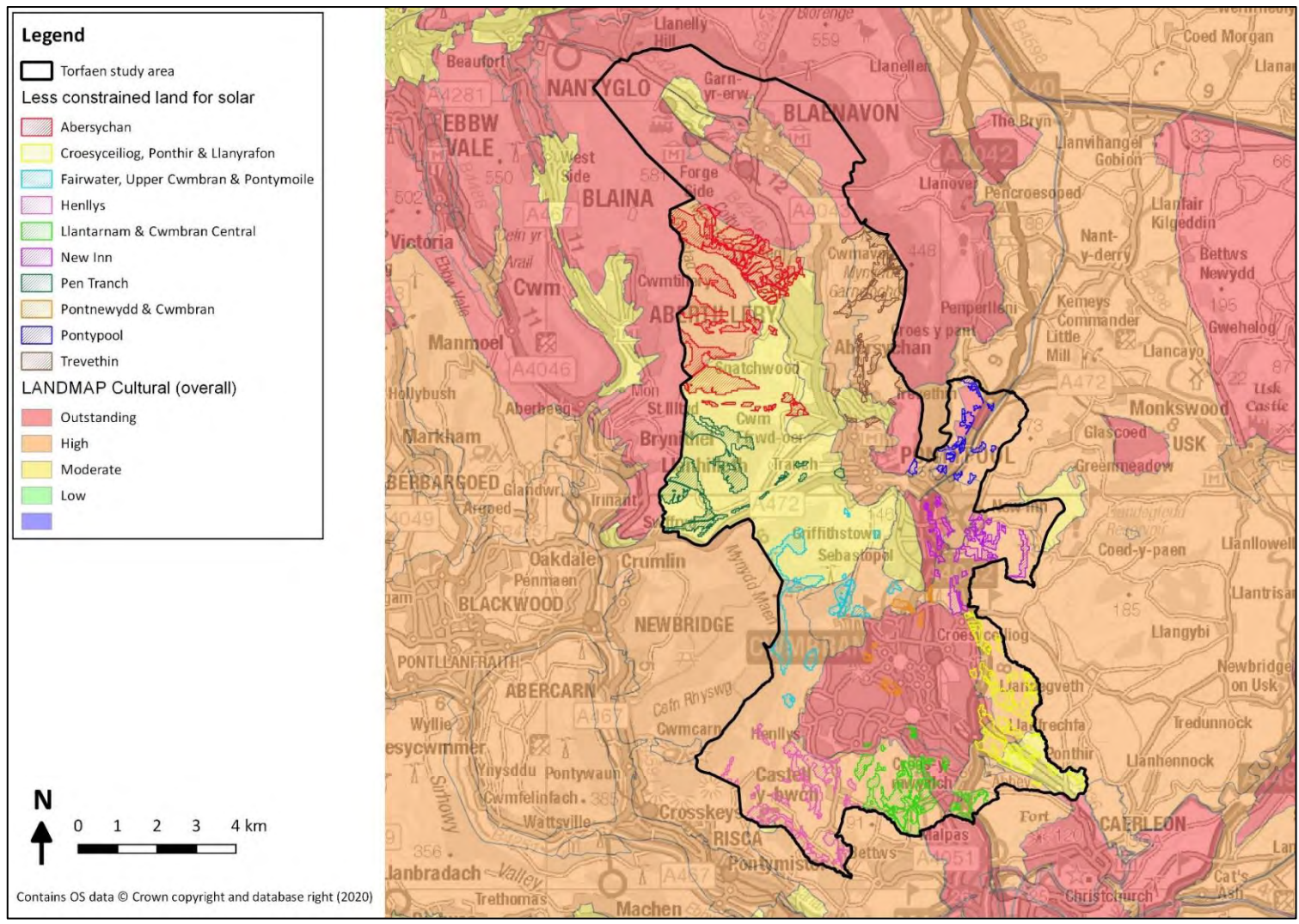


Figure 74: Less constrained land for solar (refined) and LANDMAP cultural overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

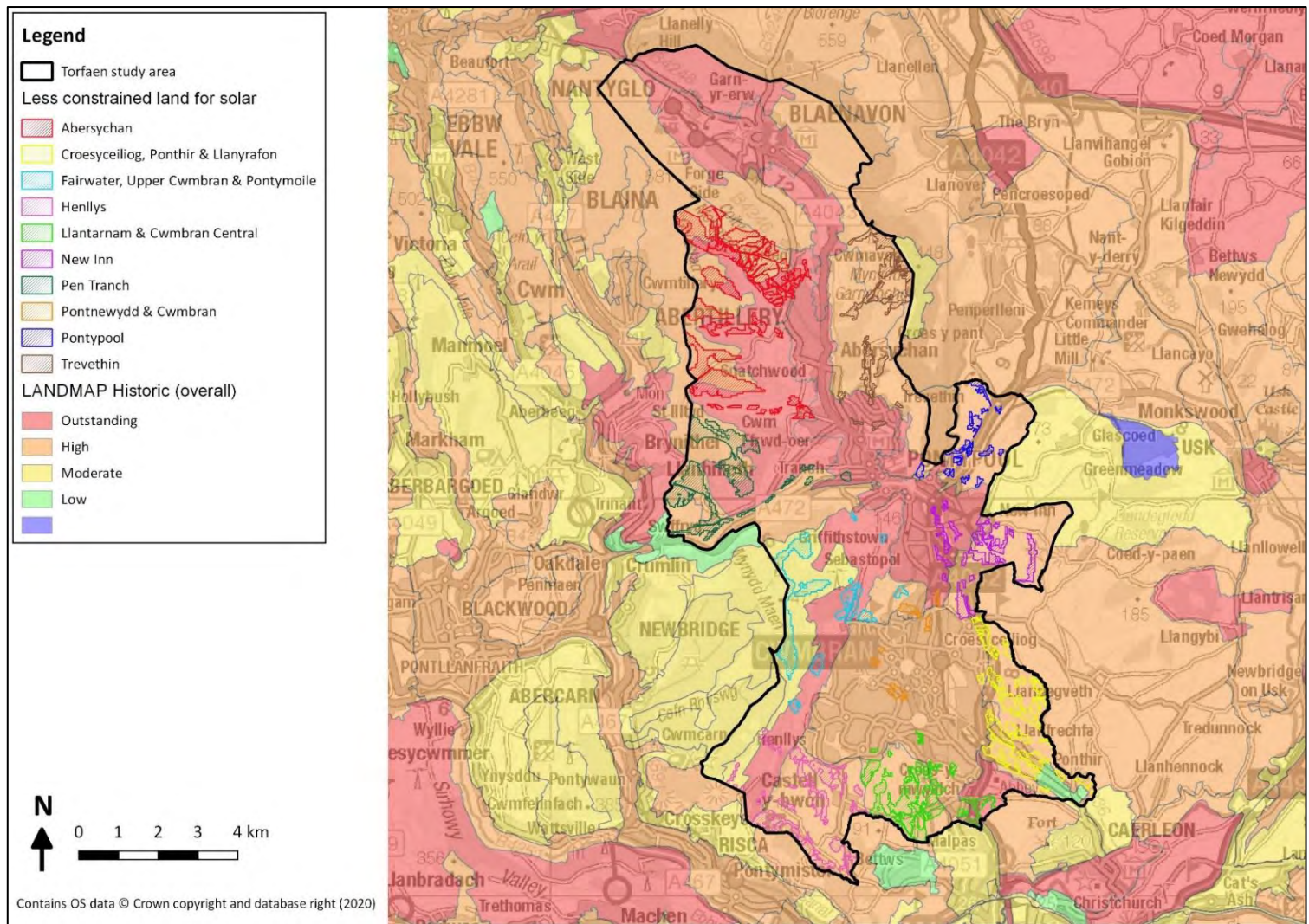


Figure 75: Less constrained land for solar (refined) and LANDMAP historic overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)



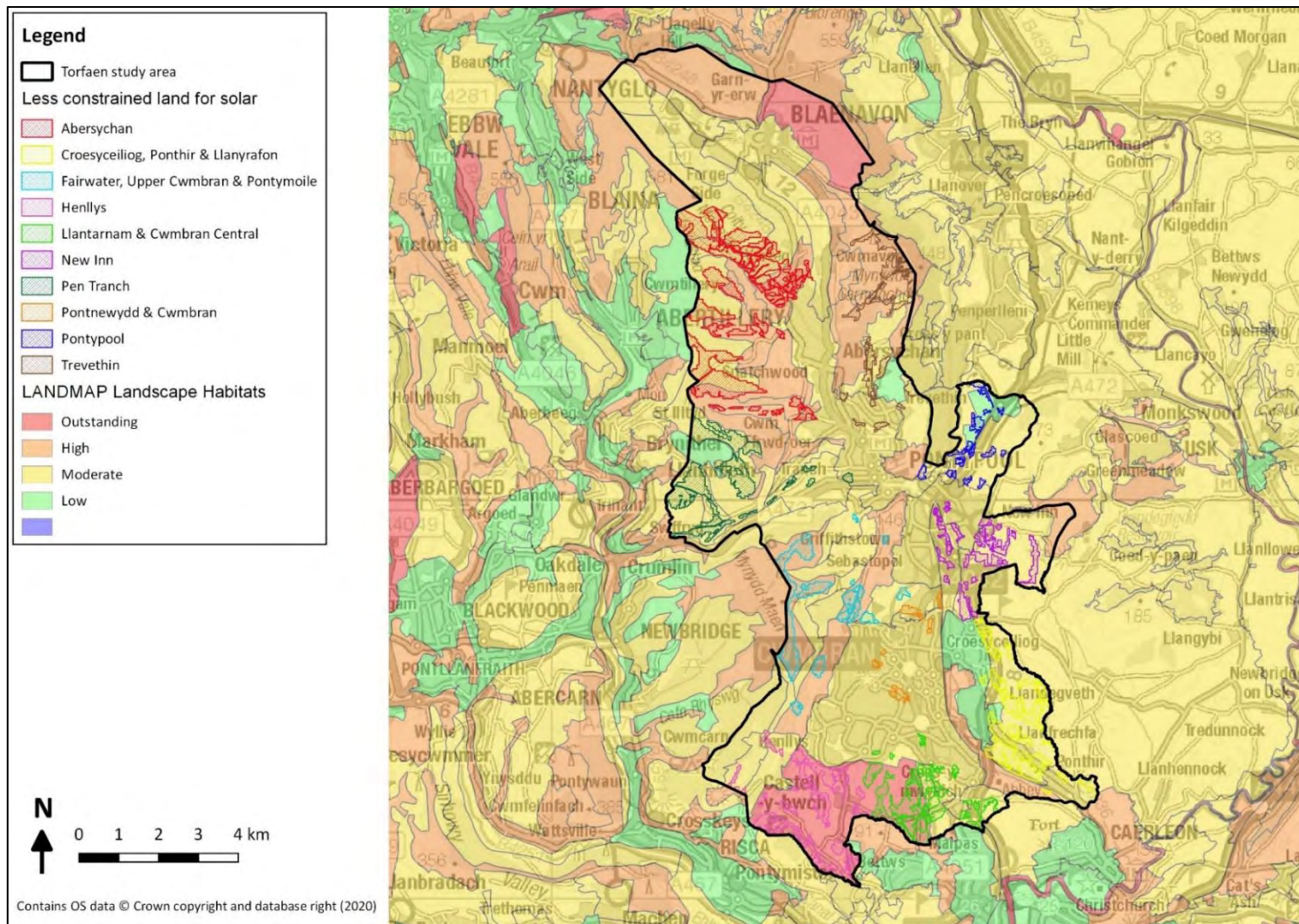


Figure 76: Less constrained land for solar (refined) and LANDMAP landscape habitats overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

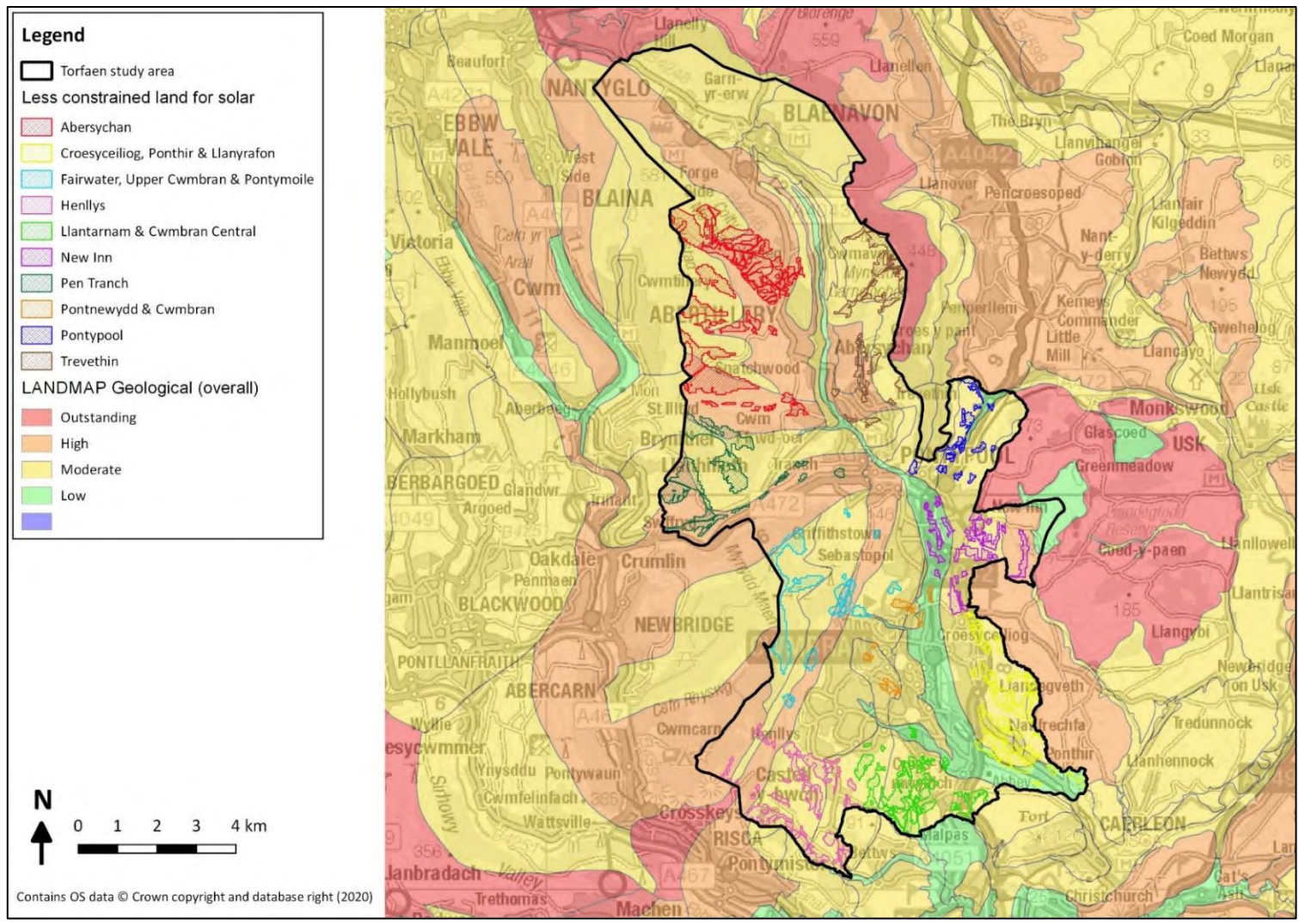


Figure 77: Less constrained land for solar (refined) and LANDMAP Geological overall rating (blue LANDMAP category indicates no classification is provided)

(Welsh Government, 2020b)

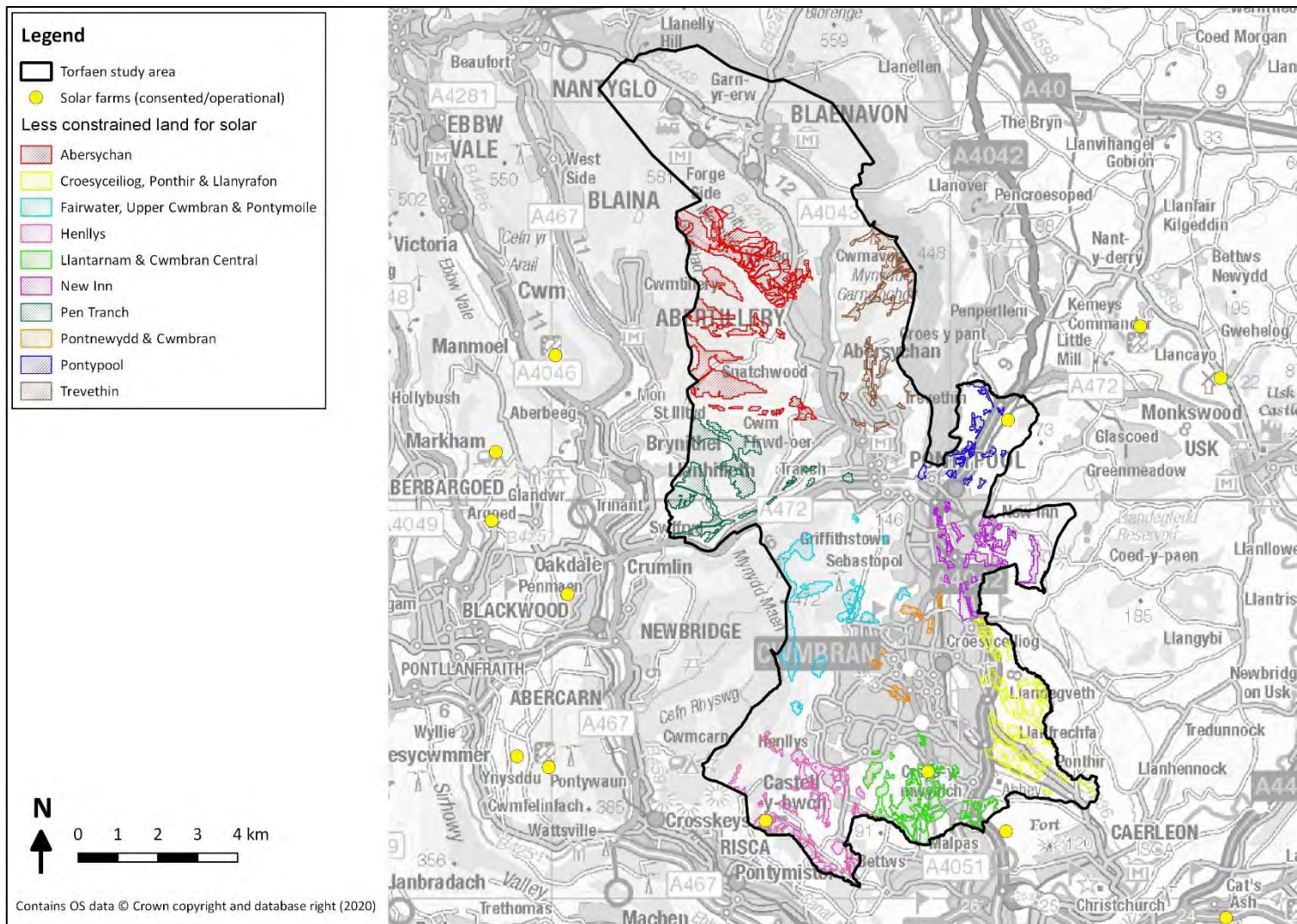


Figure 78: Less constrained land for solar (refined) and existing solar farm developments

(BEIS, 2020a)

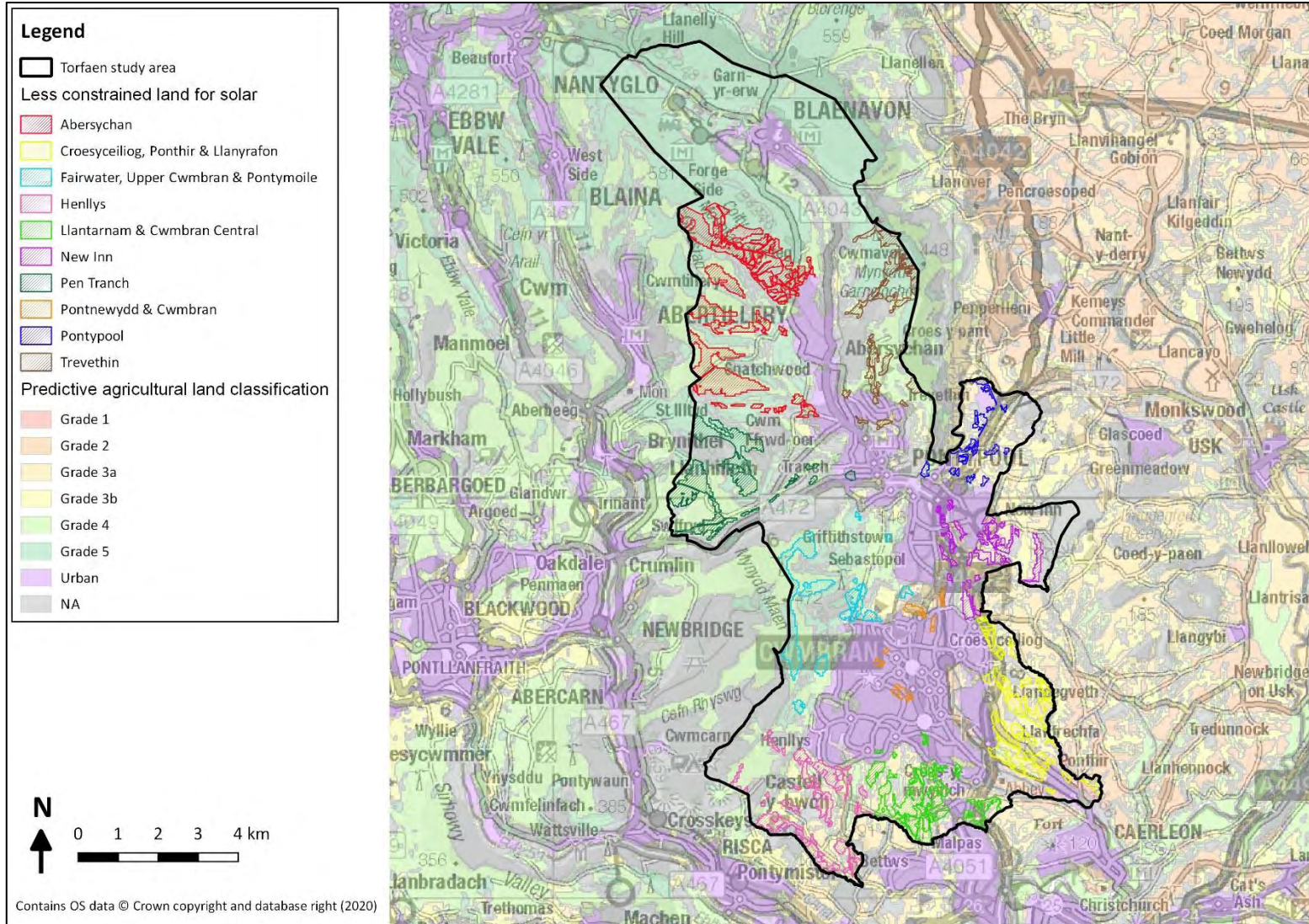


Figure 79: Less constrained land for solar (refined) and predicted agricultural land classification

(Welsh Government, 2020b)

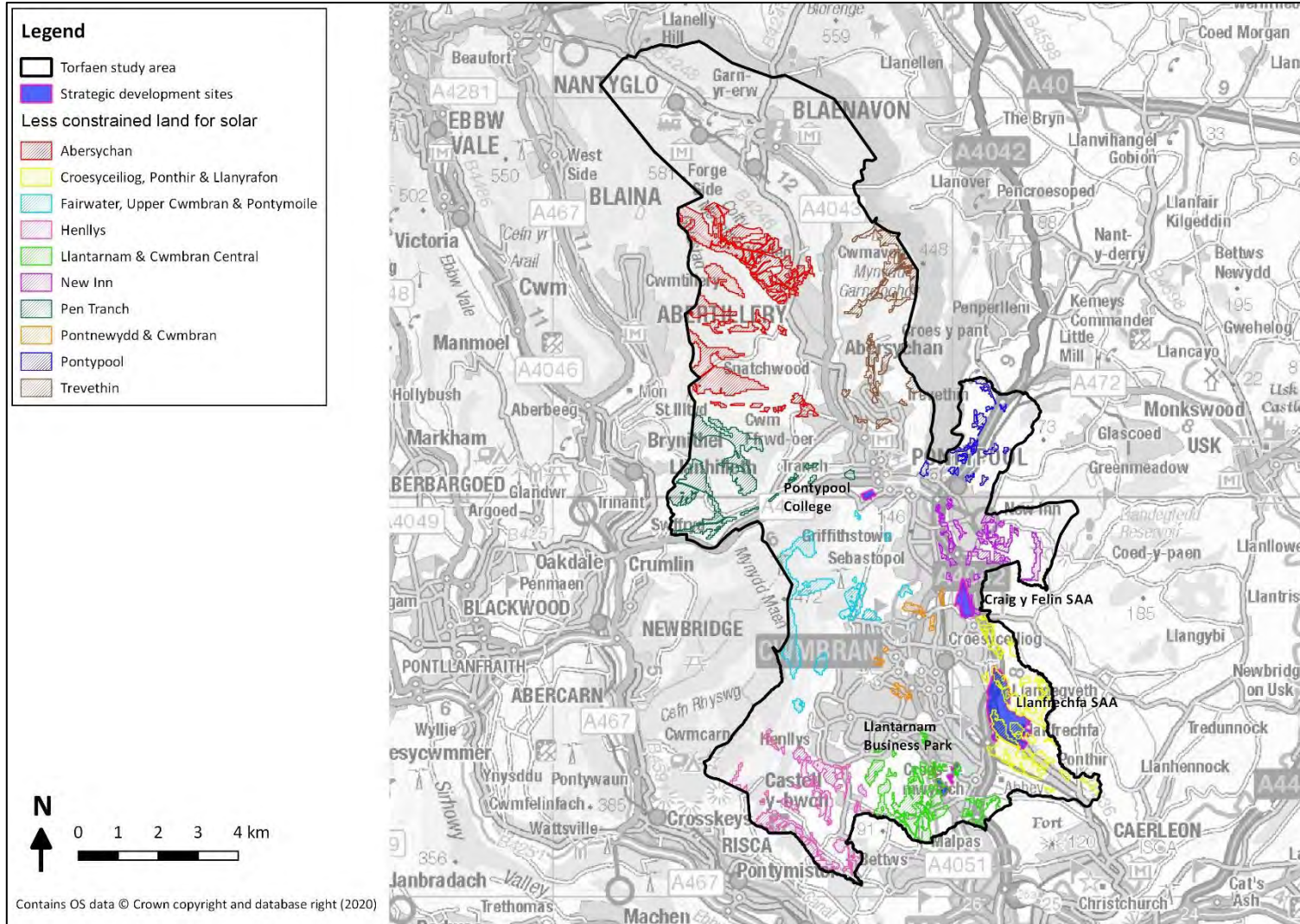


Figure 80: Less constrained land for solar (refined) and RLD strategic development sites

## Appendix 5: Non-Domestic Energy Benchmarks

Non-domestic energy benchmarks considered for use in the assessment of demand from potential anchor heat loads are summarised in Figure 80, Figure 81, Figure 82, Figure 83, Figure 84 and Figure 85. These Figures show the range in benchmarks available and the factors that can affect energy use, e.g. air conditioning, exact building use, etc.

For the purpose of this assessment mean energy intensity values provided for heating and non-heating energy uses provided by BEIS (2016) for different non-domestic use types have been used. The values are based on a survey of 3,690 buildings across Wales and England. In order to identify the heating demand from the energy intensity values an 80% efficiency factor is assumed.

The CIBSE (2012) benchmarks are discounted due to the length of time since they were produced, with respect to energy use, and do not reflect the advances that have been made with respect to energy efficiency. Additionally, the detail provided in CIBSE (2012) requires a more detailed understanding of the nature of the buildings rather than just their broad category. CIBSE is in the process of collating a new database of benchmarks via an online tool – the beta version of this tool is currently being trialled (CIBSE, 2019).

The Aecom (2016) benchmarks are ambitious with respect to energy demand for space heating and hot water, generally providing lower benchmarks for these elements, whereas the non-heating elements are generally higher than those provided by BEIS (2016).

Benchmarks provided by BEIS (2016) have been used in this assessment as they provide a more generic energy use for each of the categories provided which is considered appropriate given the final nature of the developments is currently uncertain.

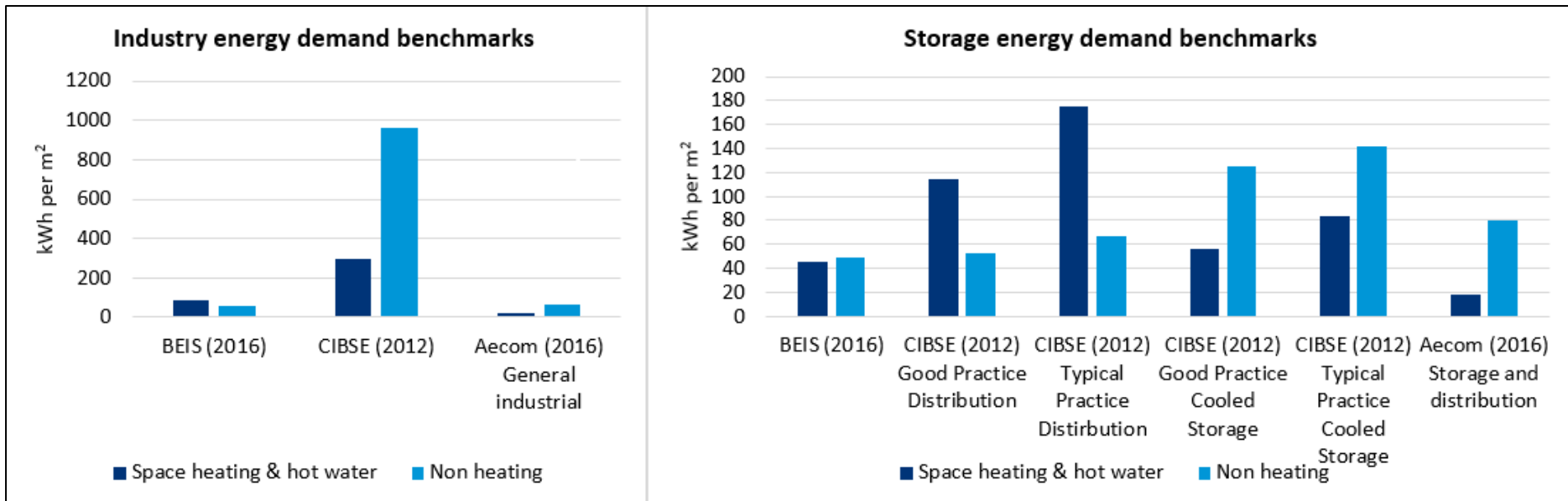


Figure 80: Industry and storage energy demand benchmarks

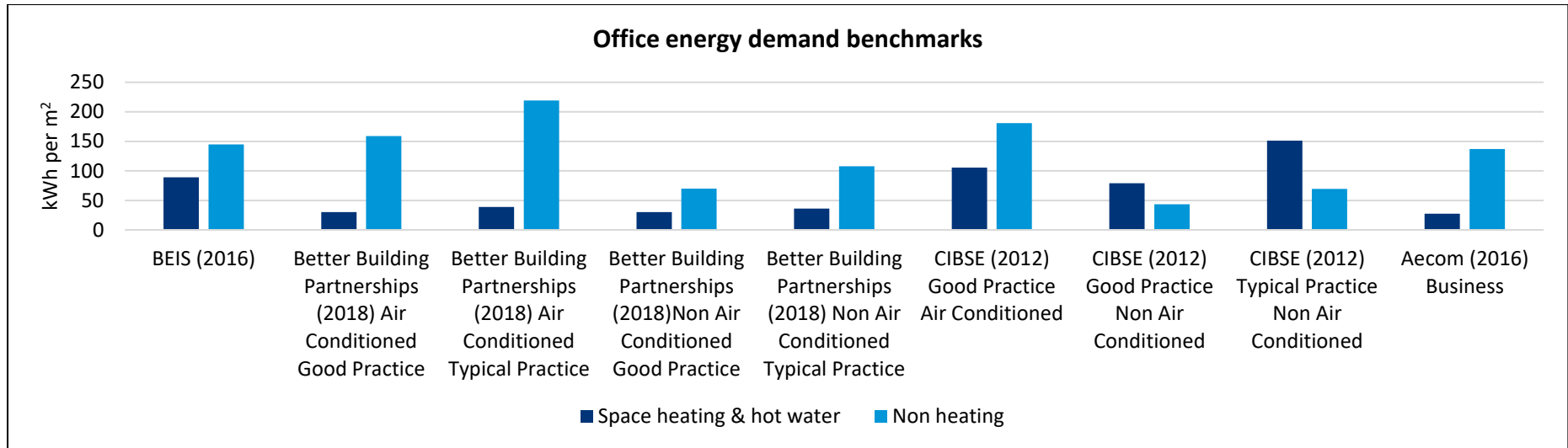


Figure 81: Office energy demand benchmarks

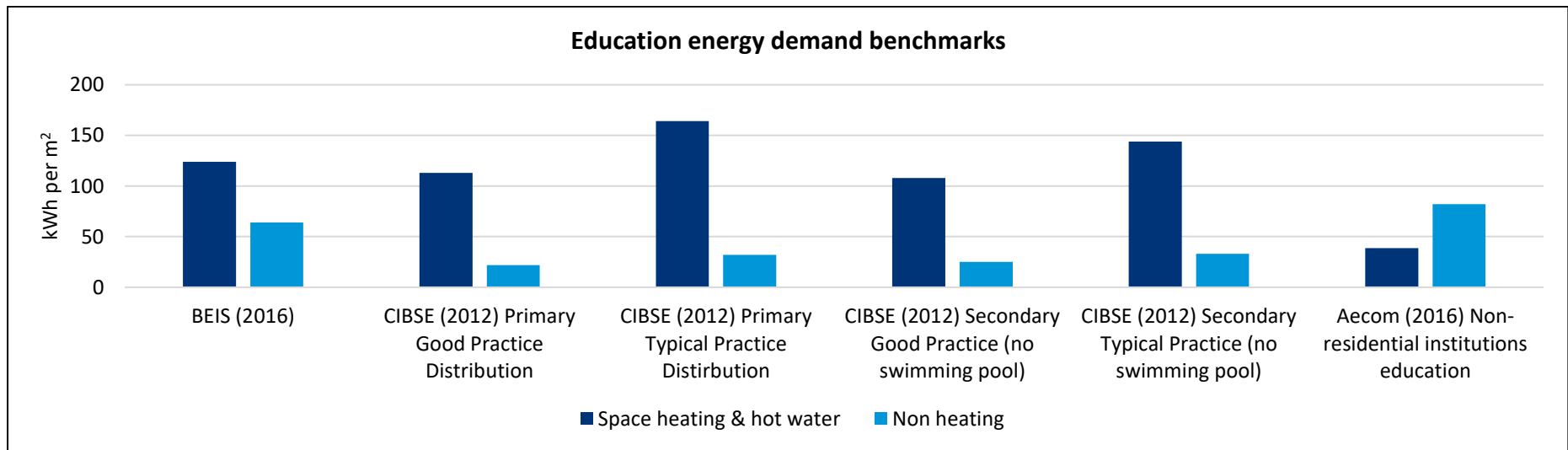


Figure 82: Education energy demand benchmarks



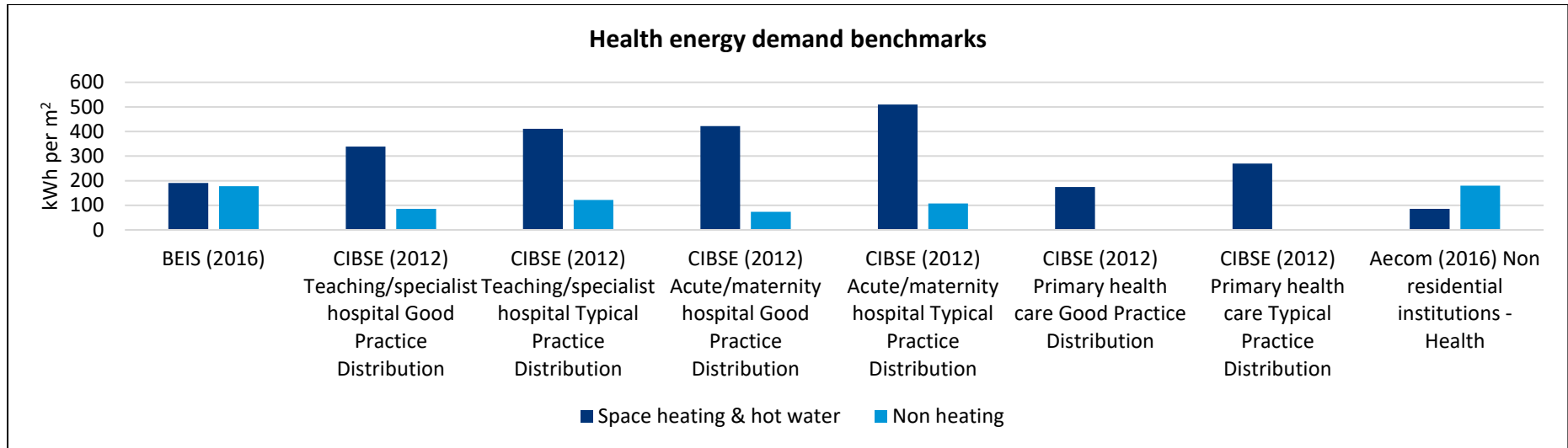


Figure 83: Health energy demand benchmarks

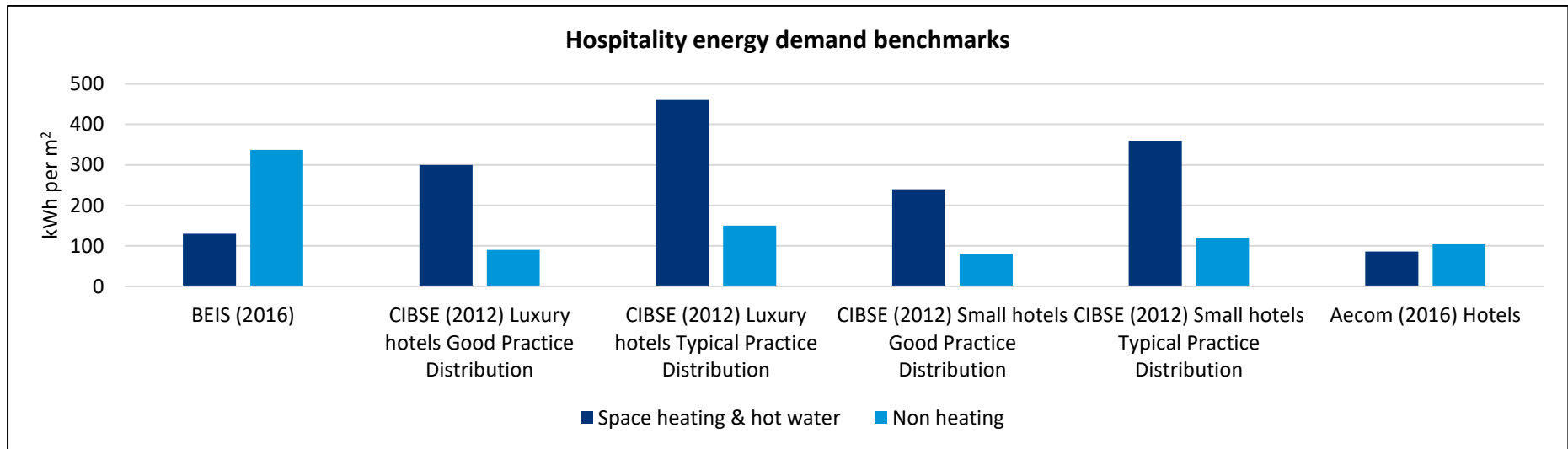


Figure 84: Hospitality energy demand benchmarks

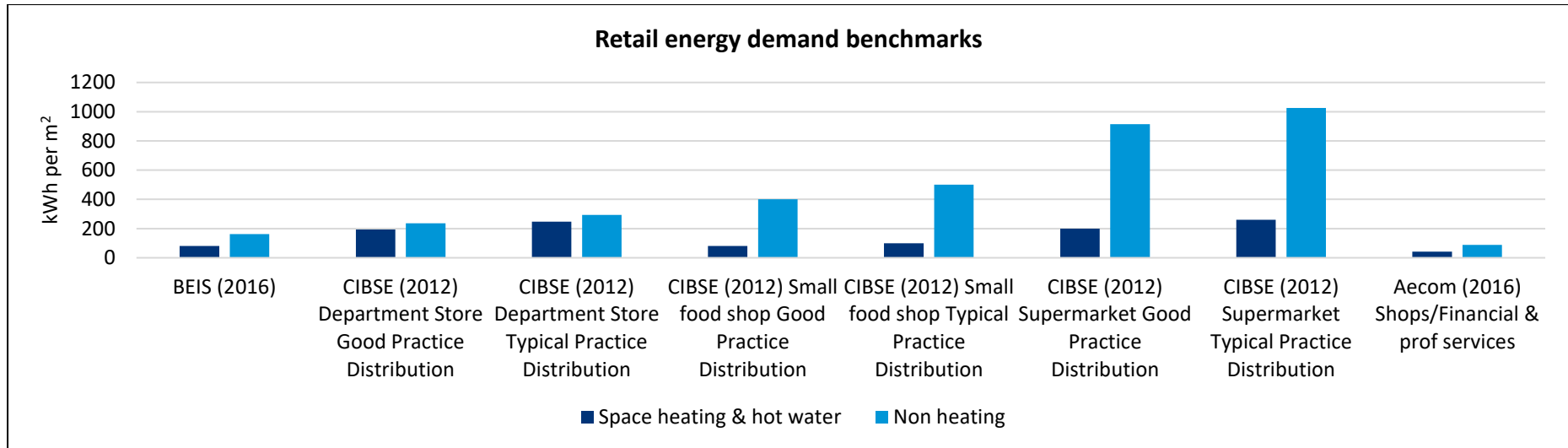


Figure 85: Retail energy demand benchmarks

#### Notes on benchmarking comparison

CIBSE (2012) Office air-conditioned benchmarks are found by taking the average between the standard air conditioning and prestige air conditioning figures.

CIBSE (2012) Office non-air-conditioned benchmarks are found by taking the average between the open plan and cellular office figures.

CIBSE (2012) Industrial energy use figures are derived by taking the average of all of the industrial sub-sectors provided.

CIBSE (2012) Warehouse figures were used to represent the storage values. Fossil fuel energy use was assumed representative of energy used for space heating and domestic hot water.

## Appendix 6: Further Appraisal of Wind and Ground Mounted Solar

Table 59: Wind cluster assessment summary and priority

Cluster	1. West of Abersychan	2. East of Abersychan	3. West of Cwmbran	4. Henllys Vale	5. Park Farm	Score
Priority	1	2	1	3	3	1 – Most constrained
Capacity (MW)	50	16	22	2	2	2
Wind resource	6.23-8.05	6.69-7.86	6.42-7.75	6.46	6.0	3
Designations within 1km	Blaenavon World Heritage Site, a Historic Landscape, Cwmavon Corridor and Tir-Pentwys LNRs, Biological SSSI, 4 scheduled monuments (SMs)	Brecon Beacons National Park, Blaenavon World Heritage Site, a historic landscape, Cwmavon Corridor LNR, a biological SSSI, 2 scheduled monuments	A geological SSSI, 5 scheduled monuments	Henllys Open Space and Llwyn Celyn LNRs	A scheduled monument	4
Landmap Visual Sensory	Overall/Character/Scenic quality: High/Moderate	Overall/Scenic quality: High Character: Moderate	Character: High/Moderate Scenic quality/Overall: High	Overall/Character/ Scenic quality: Moderate	Overall/Character/ Scenic quality: Moderate	5
Landmap Historic	Outstanding/High	High	Outstanding/Moderate	High	High	6 – Least constrained
Landmap Cultural	Outstanding/High/ Moderate	High	High/Moderate	High	High	
Landmap Landscape Habitats	High/Moderate	High/Moderate	Outstanding/High/ Moderate	Outstanding	Outstanding	
Landmap Geological	High/Moderate	Moderate	High/Moderate	Moderate	Moderate	
Aviation constraints	Partly within 20m-160m and fully within 180m-200m Primary Radar Zones	Partly within 20m-100m and fully within 120m-200m Primary Radar Zones	Partially in 20m-120m, and fully within 140-200m Primary Radar Zones	Partially in 60m and fully within 80-200m Primary Radar Zones	Fully within 60m-200m Primary Radar Zone	
Other developments	Coed y Gilfach Farm 2 0.25MW turbines in 1 km	No turbines nearby	No turbines nearby	No turbines nearby	No turbines nearby	
GSP/BSP/Primary substations	<b>GSP:</b> Uskmouth/Rassau <b>BSP:</b> Panteg/Crumlin <b>Primary:</b> Abersychan/Abertillery/Blaenavon	<b>GSP:</b> Uskmouth/Rassau <b>BSP:</b> Panteg/Pontypool North <b>Primary:</b> Pontypool North/Abersychan	<b>GSP:</b> Uskmouth <b>BSP:</b> Cwmbran/Panteg/Llantarnam <b>Primary:</b> Cwmbran/Panteg/Llantarnam	<b>GSP:</b> Uskmouth <b>BSP:</b> Llantarnam <b>Primary:</b> Llantarnam	<b>GSP:</b> Uskmouth <b>BSP:</b> Llantarnam <b>Primary:</b> Llantarnam	

Table 60: Ground mounted solar area summary and priority

Area	Abersychan	Croesyceiliog, Ponthir & Llanyrafon	Fairwater, Upper Cwmbrian & Pontymoile	Henllys	Llantarnam & Cwmbrian Central	New Inn	Pen Tranch	Pontnewydd & Cwmbrian	Pontypool	Trevethin	Score
Priority	2	2	3	7	6	4	1	3	5	3	1 – Most constrained
Capacity (MW)	262	115	95	95	98	61	122	16	26	77	2
Designations within 1km	Blaenavon WHS, Blaenavon Historic Landscape, Cwmavon Corridor LNR, 4 SMs	1 registered park/garden or their settings, 5 SMs	Church Wood & Springvale Ponds and Cwmyncyoy Quarry LNRs, 3 SMs	Henllys Open Space and Llwyn Celyn LNRs, 2 SSSIs, 4 SMs	Henllys Open Space and Llwyn Celyn LNRs, a registered park and associated gardens, 3 SMs	On the edge of the Brecon Beacons National Park, a SSSI, 1 registered park/garden or their settings	Tir Pentwys LNR, a SSSI, 1 registered park/garden or their settings, a SM	Church Wood & Springvale Ponds LNR	National Park, a SSSI, 1 registered park/garden or their settings	National Park, Blaenavon WHS, Historic Landscape, Cwmavon Corridor LNR, 1 registered park/garden/their settings, 2 SMs	3
Landmap Visual Sensory	Character: Low/Moderate, Scenic quality/Overall: Low/Moderate/High	Character/Overall: High/Low Scenic quality: Moderate/Low	Character: Moderate/High, Scenic quality/Overall: Moderate/High/Low	Character/Scenic quality/Overall: Moderate/High	Character/Scenic quality/Overall: Low/Moderate	Character/Overall: Moderate/Low Scenic quality: High/Low	Character/Scenic quality/Overall: High/Moderate/Low	Character/Overall: Moderate/Low Scenic quality: High/Low	Character/Scenic quality/Overall: Moderate	Character/Overall: Low/Moderate, Scenic quality: Low/Moderate/High	4
Landmap Historic	Outstanding/High	High	Outstanding/High/Moderate	Outstanding/High	Outstanding/High	Outstanding/High	Outstanding/High	High	High	Outstanding/High	5
Landmap Cultural	Outstanding/High/Moderate	Outstanding/High/Moderate	High/Moderate	High	Outstanding/High	Outstanding/High	Moderate	Outstanding/High	Outstanding/High	High	6 – Least constrained
Landmap Landscape Habitats	High/Moderate	High/Moderate/Low	High/Moderate	Outstanding/Moderate	Outstanding/Moderate	Moderate	Moderate	Moderate	Moderate/Low	High/Moderate	
Landmap Geological	Moderate/High	Low/Moderate	Moderate/High	Moderate/High	Moderate	Low/High	Moderate/High	Low/Moderate	Moderate	Moderate/High	
Predictive agricultural land classification	Grade 4/5	Grade 1/2/3a/3b/4/urban	Grade 3b/4/5	Grade 3a/3b/4	Grade 3a/3b/urban	Grade 2/3a/3b/Urban	Grade 4/5/urban	Grade 3a/Urban	Grade 3a/3b/4/urban	Grade 4/5	
Other developments > 1 MW (consented or operational)	Nothing nearby	Nothing nearby	Nothing nearby	Cwrt Henllys 5MW within area	Ty Coch 3 MW within area & Park Farm Solar farm 4MW within 1km	Nothing nearby	Nothing nearby	Nothing nearby	Mamhillad 5MW solar farm within area	Nothing nearby	
GSP/BSP/Primary substations	GSP: Uskmouth/Rassau BSP: Panteg/Crumlin Primary: Abersychan/Abertillery	GSP: Uskmouth BSP: Panteg/Llantarnam Primary: Panteg/Llantarnam	GSP: Uskmouth BSP: Panteg/Cwmbrian Primary: Panteg/Cwmbrian	GSP: Uskmouth BSP: Llantarnam/Cwmbrian Primary: Llantarnam/Cwmbrian/Rogerstone	GSP: Uskmouth BSP: Llantarnam Primary: Llantarnam	GSP: Uskmouth BSP: Panteg Primary: Panteg/Pontypool	GSP: Uskmouth BSP: Panteg/Crumlin Primary: Abersychan/Abertillery	GSP: Uskmouth BSP: Llantarnam/Cwmbrian Primary: Llantarnam/Cwmbrian/Panteg	GSP: Uskmouth BSP: Panteg/Pontypool North Primary: Panteg/Pontypool North	GSP: Uskmouth BSP: Panteg/Pontypool North/Abergavenny Primary: Abersychan/Pontypool North/Abergavenny	

## Appendix 7: Targets

Different scenarios could be used to inform the renewable energy deployment targets in the RLDP. The following scenarios have been considered when developing this assessment and are provided in Table 61 (the details in Table 61 are rounded for simplicity):

- > **Scenario 1:** Welsh Government (WG) Target of 70% of Electricity from Renewables by 2030.
  - **1a:** based on Wales' current (2017) national demand and TCBC's proportion based on the population of Torfaen in comparison to the whole of Wales
  - **1b:** based on Wales' current (2017) national demand and TCBC's proportion based on the land area of the study area in comparison to the whole of Wales
  - **Additional variations that could be considered:** alter demand estimations or consider a different percentage to the Welsh Government target
- > **Scenario 2:** WG Target of 1 GW of locally owned renewable energy by 2030.
  - **2a:** based on the proportion of Welsh population in Torfaen County Borough
  - **2b:** based on the proportion of Wales' land area in the study area
- > **Scenario 3:** Target a certain proportion (X%) of energy demand to be met by renewables.
  - **3a:** based on 80% of 2033 Community Renewables local electricity and heat demand estimation (energy for transport is not considered).
  - **Variations that could be considered:** alter the percentage to target, or energy demand estimation upon which the target is based
- > **Scenario 4:** National Grid Community Renewables trends applied to current installation details.
  - **4a:** based on the individual technology trends
  - **Variations that could be considered:** base on total energy generation trends
- > **Scenario 5:** Target a certain proportion (X%) of Study Area's land to dedicate for renewable energy generation.
  - **5a:** based on 10% of land area, technology breakdown: 33% solar, 33% wind, 33% woody energy crops (all of the woodland potential is included in the target).
  - **Variations that could be considered:** alter the percentage to target and the technology breakdown.
- > **Scenario 6:** Target a certain proportion (X%) of maximum theoretical capacity targeted.
  - **6a:** 50% of maximum theoretical capacity
  - **6b:** 75% of maximum theoretical capacity
  - **Variations that could be considered:** alter the percentage to target.

Table 61: Potential targets for area-based resource use

		Estimated maximum resource	Current installed capacity	Scenario 1a	Scenario 1b	Scenario 2a	Scenario 2b	Scenario 3a	Scenario 4a	Scenario 5a	Scenario 6a	Scenario 6b
Wind	MW	70	0.005						0.01 (low due to low existing capacity)	40 (20 x 2 MW turbines)	35 (18 x 2 MW turbines)	53 (27 x 2 MW turbines)
	MWh p.a.	166,000	12						24	95,000	83,000	124,000
	Household (HH) electricity demand equivalent	55,000	4						8	32,000	28,000	41,000
Ground mounted solar PV	MW	842	9						25 (~44 hectares)	238 (~412 hectares)	421 (~730 hectares)	632 (~1,094 hectares)
	MWh p.a.	737,000	8,000						22,000	209,000	369,000	553,000
	HH electricity demand equivalent	246,000	3,000						7,000	70,000	122,000	182,000
Roof-mounted solar PV	MW	126	6						27 (~9,500 dwellings)		63	94
	MWh p.a.	110,000	5,000						23,000		55,000	83,000
	HH electricity demand equivalent	37,000	2,000						8,000		18,000	28,000
Hydro	MW	1	0.03						0.03		0.4	0.6
	MWh p.a.	3,000	100						100		1,000	2,000
	HH electricity demand equivalent	1,000	30						40		500	700
Anaerobic digestion (power)	MW	0-0.01	0						0		0.007	0.01
	MWh p.a.	0-100	0						0		60	80
	HH electricity demand equivalent	0-40	0						0		20	30
Biomass (power)	MW	0-1	0.4						0.5		0.6	1
	MWh p.a.	0-9,000	3,000						4,000		4,000	7,000
	HH electricity demand equivalent	0-3,000	1,000						1,000		1,000	2,000

		Estimated maximum resource	Current installed capacity	Scenario 1a	Scenario 1b	Scenario 2a	Scenario 2b	Scenario 3a	Scenario 4a	Scenario 5a	Scenario 6a	Scenario 6b
Total power generation	MW	1,039-1,040	16	Equivalent to ~131 MW wind or ~354 MW solar PV	Equivalent to ~27 MW wind or ~72 MW solar PV			Equivalent to ~140 MW wind or ~378 MW solar PV	520	278	520	780
	MWh p.a.	1,016,000 - 1,025,000	16,000	310,000	63,000			331,000	512,000	303,136	512,000	769,000
	HH electricity demand equivalent	339,000-342,000	5,000	103,000	21,000			110,000	171,000	101,000	171,000	256,000
Anaerobic digestion (heat)	MW	0.02-0.07	0						0.01	0.02	0.01	0.02
	MWh p.a.	90-287	0						50	70	50	70
	HH heat demand equivalent	9-30	0						5	8	5	8
Heat pumps	MW	421	1						211	316	211	316
	MWh p.a.	756,000	2,000						369,000	554,000	369,000	554,000
	HH heat demand equivalent	77,000	200						37,000	56,000	37,000	56,000
Biomass (heat)	MW	2-10	4						1	8	1	8
	MWh p.a.	10,000-27,000	11,000						3,000	20,000	3,000	20,000
	HH heat demand equivalent	1,000-3,000	1,000						200	1,000	200	1,000
Total heat	MW	422-432	5					<i>Depends on technology</i>	212	324	212	324
	MWh p.a.	766,000 - 783,000	12,000					527,000	372,000	574,000	372,000	574,000
	HH heat demand equivalent	78,000-79,000	1,000					53,000	38,000	57,000	38,000	57,000
Total power & heat	MW	1,462-1,470	20	Equivalent to ~131 MW wind or ~354 MW solar PV	Equivalent to ~27 MW wind or ~72 MW solar PV	30	6	<i>Depends on technology</i>	732	1,104	732	1,104
	MWh p.a.	1,782,000 - 1,799,000	29,000	190,000	230,000	<i>Depends on technology</i>	<i>Depends on technology</i>	858,000	885,000	1,343,000	885,000	1,343,000

## Appendix 8: Explanation of Terms

<b>Anaerobic Digestion:</b>	Anaerobic digestion refers to the process whereby organic material is broken down in an oxygen-free environment to produce biogas (predominantly a mixture of methane and carbon dioxide), which can be burnt to produce heat/power or upgraded to biomethane (an alternative to natural gas).
<b>Carbon budgets:</b>	To assist with meeting the UK's 2050 carbon reduction targets, the UK government has set five-yearly carbon budgets (up to 2032), which set the amount of greenhouse gases that the UK can legally produce. Welsh Government has set Wales' specific carbon budgets.
<b>District heat networks:</b>	District heat networks generate heat in a central energy centre and distribute the heat to a number of buildings through a network of insulated pipes. Heat is transferred from the network of pipes to the buildings via a heat exchanger.
<b>Electrification of heat and transport:</b>	It is anticipated that heating and transport will increasingly become electrified in the future, i.e. there will be increasing numbers of electric vehicles and heating will be increasingly provided by electricity rather than direct fossil fuels.
<b>Energy from Waste:</b>	The assessment estimated the potential for energy generation from waste via direct combustion.
<b>Future energy demand estimations:</b>	Future energy demand cannot be confidently predicted on either a local or national level. All projections/estimations will be dependent on assumptions relating to the market, regulations, policies etc. Two estimates of future energy demand are provided within the assessment to illustrate the range of estimates available which vary due to uncertainties regarding the underlying contributory factors.
<b>GIS constraints mapping:</b>	GIS stands for "Geographic Information Systems", it is mapping software, which allows analysis of spatial and geographical data. GIS was used with spatial data on "constraints", e.g. nature reserves, low wind speed, built-up areas, etc. to identify the areas considered as "less-constrained" for wind and solar. It was also used with spatial data on resource, e.g. woodland and agricultural land to identify areas of biomass fuel potential.



<b>Grid constraints:</b>	The electricity network was designed and built based on a traditional energy system, in which energy is generated in a centralised manner from large thermally driven electricity generators and then distributed across the country with the voltage gradually reducing as the network reaches smaller electricity users. Large-scale increases in de-centralised generation is using up the available capacity in the existing infrastructure. When the available capacity is fully utilised constraints are encountered and additional investment is required to either upgrade or reinforce existing infrastructure.
<b>Heat Pumps:</b>	Heat pumps deliver more thermal energy than the electrical energy consumed (the ratio between thermal output and electrical input is the “Coefficient of Performance”), by extracting and compressing heat from an external source. Heat pumps can be extracted from the air (air source heat pumps) or ground/water (ground source heat pumps). Hybrid heat pumps utilise a heat pump and gas boiler in one heating system.
<b>Repower:</b>	The upgrading or continuation of operation of existing renewable energy generation assets beyond the time period of their initial planning consent.
<b>Typical household consumption values:</b>	Typical household consumption values for gas and electricity are used to convert the energy values provided in the assessment into an equivalent number of households’ demand. It is worth noting that typical household consumption values are likely to change in the future with increasing electrification of heat and transport, as well as increasing energy efficiency.

The Carbon Trust is an independent company with a mission to accelerate the move to a sustainable, low-carbon economy. The Carbon Trust:

- > advises businesses, governments and the public sector on opportunities in a sustainable, low-carbon world;
- > measures and certifies the environmental footprint of organisations, products and services;
- > helps develop and deploy low-carbon technologies and solutions, from energy efficiency to renewable power.

[www.carbontrust.com](http://www.carbontrust.com)

**+44 (0) 20 7170 7000**

Whilst reasonable steps have been taken to ensure that the information contained within this publication is correct, the authors, the Carbon Trust, its agents, contractors and sub-contractors give no warranty and make no representation as to its accuracy and accept no liability for any errors or omissions. Any trademarks, service marks or logos used in this publication, and copyright in it, are the property of the Carbon Trust. Nothing in this publication shall be construed as granting any licence or right to use or reproduce any of the trademarks, service marks, logos, copyright or any proprietary information in any way without the Carbon Trust's prior written permission. The Carbon Trust enforces infringements of its intellectual property rights to the full extent permitted by law.

The Carbon Trust is a company limited by guarantee and registered in England and Wales under Company number 4190230 with its Registered Office at: 4th Floor, Dorset House, 27-45 Stamford Street, London SE1 9NT.

Published in the UK: 2020

© The Carbon Trust 2020. All rights reserved.

