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BRE Client Report

BRE Integrated Dwelling Level Housing Stock Modelling and Database for London Borough of Ealing

Prepared for: **Lisa Watson**

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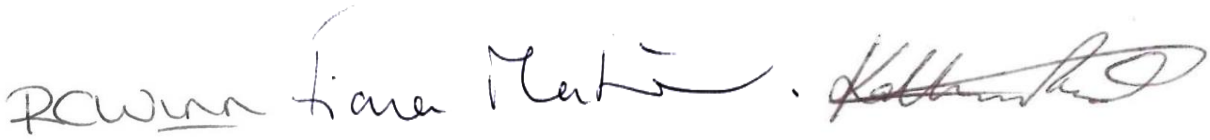
Signature 

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Executive summary

- The London Borough of Ealing commissioned BRE to undertake a series of modelling exercises on their housing stock which required BRE to produce an integrated stock model which includes Local Land and Property Gazetteer (LLPG), tenure, benefits and Houses in Multiple Occupation (HMO) data including additional HMO and selective licensing data provided by the London Borough of Ealing. The BRE models also integrate Energy Performance Certificate (EPC)[1] data. As a result of this, 72,732 addresses have had their imputed energy characteristics replaced with observed characteristics from the EPC data for the purposes of the energy model. The use of this observed data will lead to more accurate energy models for these cases, which account for 50.4% of the total stock in Ealing.
- This report describes the work and the results obtained from the integrated model and Housing Stock Condition Database (HSCD). Access to the HSCD is also provided to the council to enable them to obtain specific information whenever required.
- The detailed housing stock information provided in this report will facilitate the delivery of the London Borough of Ealing's housing strategy and enable a targeted intervention approach to improving housing. In addition to this there are also several relevant government policies – the Housing Act 2004, Housing Strategy Policy, Local Authority Housing Statistics (LAHS) and the Energy Companies Obligation (ECO).
- The main aims of this work were to provide estimates of:
    - The percentage of dwellings with the presence of each of the Housing Standards Variables[2] for Ealing overall and broken down by tenure and then mapped by Census Output Area (COA) (private sector stock only) and including category 2 hazards
    - Information relating to LAHS reporting for the private sector stock - category 1 hazards and Houses in Multiple Occupation (HMOs) as well as information on EPC ratings
    - Energy efficiency variables for the private sector stock (wall and loft insulation)
    - Energy planning variables (SimpleCO_2, energy and heat demand, energy and heat cost)
    - Improvement scenarios
    - Additional modelling analysis to determine the estimated potential costs required to improve SimpleSAP ratings to a) 65 and b) 75

[1] EPCs are an indication of how energy efficient a building is - with a rating from A (very efficient) to G (inefficient). They are required whenever a property is built, sold or rented.

[2] Presence of an HHSRS category 1 hazard, presence of a category 1 hazard for excess cold, presence of a category 1 hazard for falls, dwellings in disrepair, fuel poverty (10% and Low Income High Cost definitions), dwelling occupied by a low income household and SimpleSAP rating. In addition, Ealing have requested the inclusion of category 2 hazards.

- BRE Housing Stock Models were used to provide such estimates at dwelling level and focussing on private sector housing. The Housing Standards Variables provide Ealing with detailed information on the likely condition of the stock and the geographical distribution of properties of interest.
- A stock modelling approach has been developed and used by BRE for many years and the most recent 2018 models have been updated to make use of the results of the 2015 English Housing Survey (EHS)[3]. The models also make use of Experian and Ordnance Survey (OS) data. OS AddressBase Plus is used as a basis for the list of all dwellings in the authority, and applying improved geo-modelling[4] is used to determine the dwelling type and floor area from OS Mastermap. The energy model that lies at the heart of the modelling process is based on the 2012 version of SAP, and the methods for imputing the inputs to this model incorporate information from additional sources. These include the age of postcodes (to improve dwelling age data) and data from Xoserve to determine whether the dwelling is on the gas network. These dwelling level models are used to estimate the likelihood of a particular dwelling meeting the criteria for each of the Housing Standards Variables. These outputs can then be mapped to provide the authority with a geographical distribution of each of the variables which can then be used to target resources for improving the housing stock.
- Furthermore, the London Borough of Ealing provided additional sources of "local data" – Local Land and Property Gazetteer (LLPG), tenure, benefits and Houses in Multiple Occupation (HMO) data including additional HMO and selective licensing data. Energy Performance Certificate (EPC) data is also integrated by BRE. These data sets were then incorporated into the BRE Housing Stock Model to produce an integrated Housing Stock Condition Database (HSCD).
- The headline results are provided on the following page:

[3] 2015 is the latest available data. Prior to the 2018 models EHS 2014 data was used.

[4] The OS data has been used to update a number of the model inputs – the main value of the OS data is the ability to determine the dwelling type with much greater confidence – see **Appendix B** for more information.

Headline results for Ealing

There are 144,380 dwellings in Ealing, 49% are owner occupied, 33% private rented and 18% social rented.

11,782 dwellings in the private sector have category 1 Housing Health and Safety Rating System (HHSRS) hazards. This equates to 10% of properties. 50,519 dwellings in the private sector have category 2 hazards (43% of properties in this sector) *See full results*

3,814 dwellings in the private rented sector have category 1 HHSRS hazards. This equates to 8% of properties in the private rented sector. 21,144 dwellings in the private rented sector have category 2 HHSRS hazards (44% of properties in this sector). *See full results*

The highest concentrations of all HHSRS hazards in the private sector are found in the wards of Walpole, Lady Margaret and Greenford Green. *See full results*

The highest concentrations of fuel poverty (Low Income High Costs definition) in the private sector are found in the wards of Acton Central, Walpole and South Acton and for excess cold the highest concentrations are in Greenford Green, Hobbayne and Lady Margaret. *See full results*

The average SimpleSAP rating for all private sector dwellings in Ealing is 57, which is worse than both England (60) and London (60). For owner occupied stock the figure is 55 and for private rented stock it is 61. *See full results*

Maps by Census Output Area (COA) have been provided for the above Housing Standards Variables. *See maps*

The total cost of mitigating category 1 hazards in Ealing's private sector stock is estimated to be £45.4 million – with £30.7 million in the owner occupied sector, and £14.7 million in the private rented sector. *See full results*

There are an estimated 6,957 HMOs in Ealing, of which approximately 2,308 come under the mandatory licensing scheme. *See full results*

8.6% (10,151) of *private sector* dwellings and 5.3% (2,530) of *private rented* dwellings in Ealing are estimated to have an EPC rating below band E. *See full results*

In the private sector stock, there are an estimated 18,335 dwellings with un-insulated cavity walls and 21,429 dwellings with less than 100mm of loft insulation. *See full results*

Analysis of the energy efficiency variables indicates that the owner occupied stock has the highest average figures for most variables (SimpleCO_2, energy and heat demand, energy and heat cost and electricity cost). *See full results*

An improvement scenario involving a package of work with low cost measures, heating, double glazing, solid wall insulation and solar hot water provides high levels of savings – around a 39% reduction in energy demand. However, simply implementing low cost measures and heating would provide a reduction of around 15%. *See full results*

Headline results continued

An additional analysis was carried out to determine the estimated potential costs required to improve SimpleSAP ratings to a) 65 and b) 75.

Applying the scenario which incorporated the majority of the improvement measures (low costs, measures, heating, double glazing, solid wall insulation and solar water heating) resulted in 88% of dwellings achieving a SimpleSAP rating of 65 at a cost of £1,378m. The remaining 12% of dwellings could not reach a SimpleSAP of 65 with the improvement measures applied.

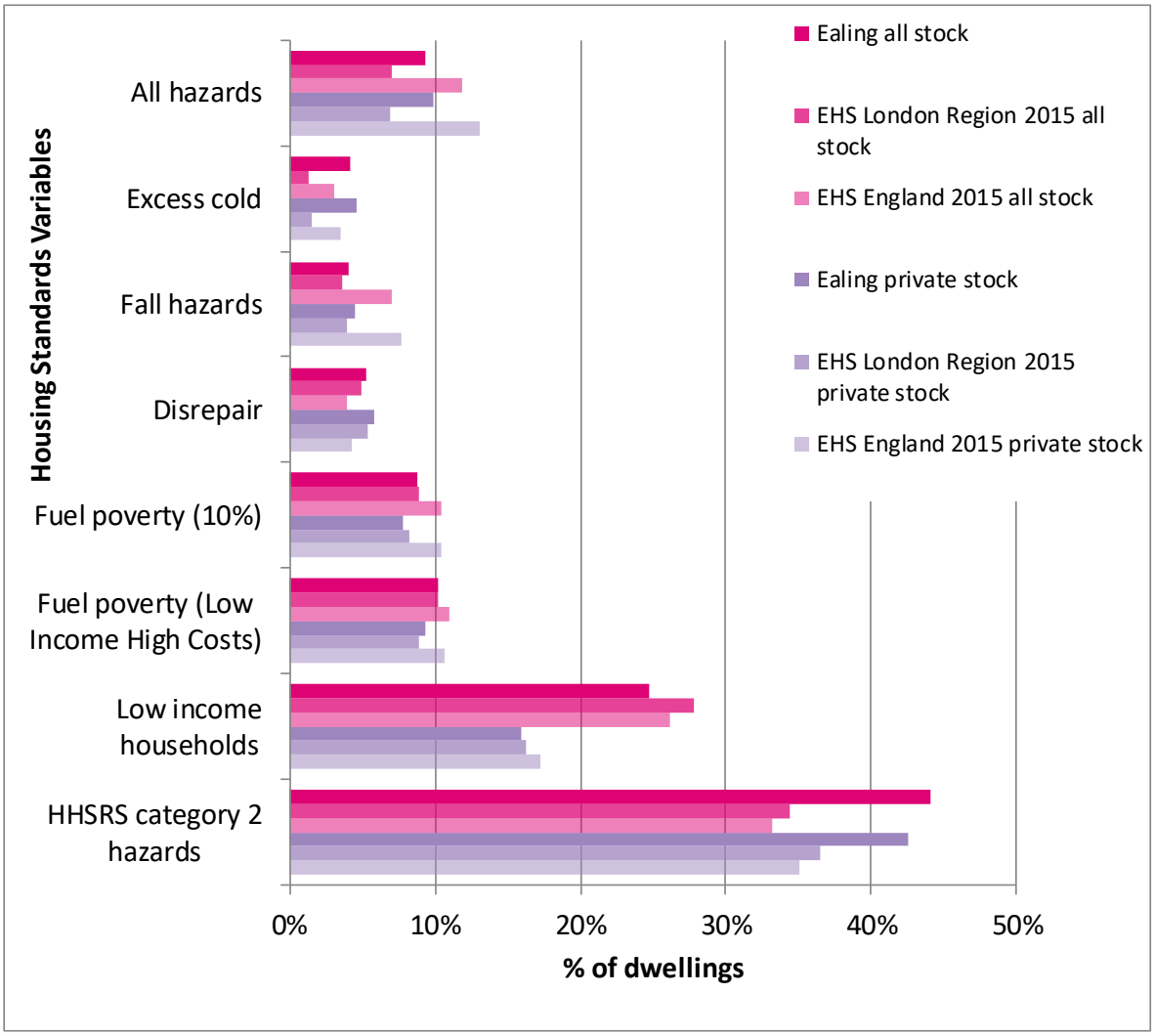
The same scenario resulted in 61% of dwellings achieving a SimpleSAP rating of 70 at a cost of £745m, with the remaining 39% of dwellings not able to achieve a rating of 70.

See full results

Key illustrations of headline results

- The figure below shows the results for 7 of the Housing Standards Variables in Ealing compared to regional data and England (EHS 2015) - split into all stock and private sector stock. The data shows that the performance of the housing stock in Ealing compared to the EHS England average is mixed, with Ealing performing slightly better for all hazards, fall hazards, fuel poverty (both definitions) and low income households, but worse for excess cold and disrepair. Compared to the regional average the picture is similar with Ealing performing worse for all hazards, excess cold, falls and disrepair.

Estimates of the percentage of dwellings with the presence of each of the Housing Standards Variables criteria assessed by the housing stock models and HSCD for all stock and private sector stock – Ealing compared to the London and England (EHS 2015)



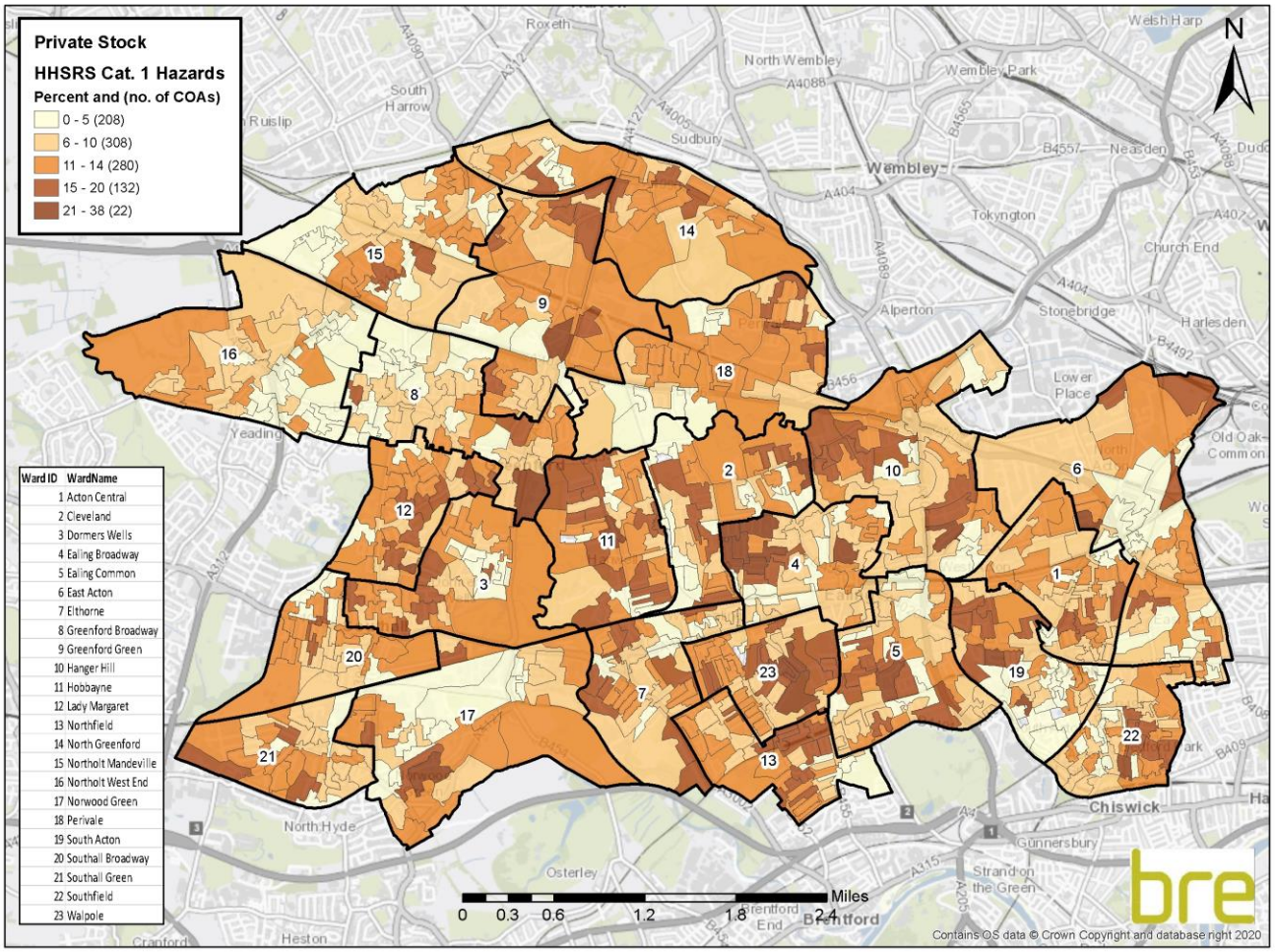
- The table below shows the number and percentage of Ealing's private rented stock falling into each of the EPC ratings bands (based on SimpleSAP). The number of private rented dwellings in Ealing with a rating below band E (i.e. bands F and G), is estimated to be 2,530 (5.3%). Compared to England, there is a greater proportion of dwellings in bands C, E and F and lower proportions in bands D and G.

Number and percentage of Ealing's private rented stock falling into each of the EPC ratings bands (based on SimpleSAP)

	Ealing		2015 EHS England
	Count	Percent	Percent
(92-100) A	0	0.0%	1.2%
(81-91) B	1,664	3.5%	
(69-80) C	12,584	26.2%	25.3%
(55-68) D	19,846	41.3%	49.1%
(39-54) E	11,401	23.7%	18.1%
(21-38) F	2,241	4.7%	4.5%
(1-20) G	289	0.6%	1.8%

- The map overleaf shows the distribution of category 1 hazards, as defined by the Housing Health and Safety Rating System (HHSRS). The highest concentrations are distributed across the Ealing area, in particular the wards of Walpole, Lady Margaret and Greenford Green.

Percentage of private sector dwellings in Ealing with the presence of a HHSRS category 1 hazard



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1 Introduction

The London Borough of Ealing commissioned BRE to undertake a series of modelling exercises on their housing stock. BRE integrated data provided by the authority into the models to produce an integrated database and corresponding report. This report describes the modelling work and provides details of the results obtained from the integrated dwelling level model and database.

The London Borough of Ealing provided Local Land and Property Gazetteer (LLPG), tenure, benefits and Houses in Multiple Occupation (HMO) data including additional HMO and selective licensing data . The BRE Model also integrates Energy Performance Certificate (EPC) data and, as a result of this, 72,732 addresses have had their imputed energy characteristics replaced with observed characteristics from the EPC data for the purposes of the energy model. The use of this observed data will lead to more accurate energy models for these cases, which account for 50.4% of the total housing stock in Ealing.

The BRE Housing Stock Model data is provided to the council via the online Housing Stock Condition Database (HSCD) to enable them to obtain specific information whenever required.

The BRE Housing Stock Models provide the council with dwelling level information on various Housing Standards Variables, focussing on private sector housing. These variables provide the London Borough of Ealing with detailed information on the likely condition of the stock and the geographical distribution of properties of interest. These properties are likely to be suitable targets for energy efficiency improvements or other forms of intervention, such as mitigating Housing Health and Safety Rating System (HHSRS) hazards. The variables are split into categories related to house condition, energy efficiency and household vulnerability as shown in **Table 1** (see **Appendix A** for full definitions).

Table 1: Housing Standards Variables split into categories

Housing Standards Variable	House condition variables	Energy efficiency variables	Household vulnerability variables
Presence of HHSRS cat 1 hazard	✓		
Presence of cat 1 hazard for excess cold	✓	✓	
Presence of cat 1 hazard for falls	✓		
Dwellings in disrepair	✓		
Fuel Poverty (10% & Low Income, High Cost definitions)			✓
Dwellings occupied by low income households			✓
SimpleSAP rating		✓	

N.B. Presence of category 1 hazard for falls does NOT include the hazard of falling between levels

The single variables shown in **Table 1** can also be brought together within the HSCD to provide powerful information on the housing stock; for example, dwellings suffering from excess cold and also occupied by households on a low income. This enables council officers to explore the stock and to assess the likely scope of any programmes they might wish to implement.

The information in this report includes estimates relating to the Ministry of Housing, Communities and Local Government's (MHCLG) Local Authority Housing Statistics (LAHS) reporting of costs of mitigating hazards, numbers of Houses in Multiple Occupation (HMOs) as well as providing information relating to Energy Performance Certificate (EPC) ratings.

The Housing Standards Variables and other information are derived from the BRE Dwelling Level Stock Models. These Models have been used for many years to provide key Housing Standards Variables to local authorities. The most recent 2018 models have been updated to make use of the results of the 2015 English Housing Survey (EHS)[5]. The models also make use of Experian and Ordnance Survey (OS) data. OS AddressBase Plus is used as a basis for the list of all residential dwellings in the authority. OS Mastermap is also linked to OS AddressBase to allow dwelling type and floor area to be determined through geographical modelling[6]. Other national data sources used by the Model include the age of postcodes (to improve dwelling age data) and data from Xoserve to determine whether the dwelling is on the gas network. These dwelling level models are used to estimate the likelihood of a dwelling meeting the criteria for each of the Housing Standards Variables. These outputs can then be mapped to provide the authority with a geographical distribution of each of the variables which can then be used to target resources for improving the housing stock.

As described above, in this particular case, the database was further enhanced by the addition of local data sources which were identified by the London Borough of Ealing. These local data sources were incorporated into the stock models to produce the integrated database.

The information in the HSCD can be used to ensure the council meets various policy and reporting requirements. For example, local housing authorities are required to review housing conditions in their districts in accordance with the Housing Act 2004[7].

Furthermore, having this information available will also help to facilitate the delivery of the London Borough of Ealing's housing strategy. It will enable a targeted intervention approach to improving housing; therefore, allowing the council to concentrate their resources on housing in the poorest condition or with the greatest health impact.

[5] 2015 is the latest available data. Prior to the 2018 models EHS 2014 data was used.

[6] The OS data has been used to update a number of the model inputs – the main value of the OS data is the ability to determine the dwelling type with much greater confidence – see **Appendix B** for more information.

[7] http://www.legislation.gov.uk/ukpga/2004/34/contents

1.1 Project aims

The main purpose of this project was to provide data on key private sector housing variables for Ealing. The main aims were therefore to provide estimates of:

- The percentage of dwellings with the presence of each of the Housing Standards Variables for Ealing overall, broken down by tenure and mapped by Census Output Area (COA) (private sector stock only), and including category 2 hazards
- Information relating to LAHS reporting for the private sector stock - category 1 hazards and HMOs, plus information on EPC ratings
- Energy efficiency variables for the private sector stock (wall and loft insulation)
- Energy planning variables (SimpleCO_2, energy and heat demand, energy and heat cost)
- Improvement scenarios
- Additional modelling analysis to determine the estimated potential costs required to improve SimpleSAP ratings to a) 65 and b) 75

This report looks firstly at the policy background and why such information is important for local authorities. Secondly, it provides a brief description of the overall stock modelling approach and the integration of the local data sources. Finally, this report provides the modelling results for Ealing covering each of the main aims above.

2 Policy background

The detailed housing stock information provided in this report will facilitate the delivery of the London Borough of Ealing's housing strategy and enable a targeted intervention approach to improving housing. This strategy needs to be set in the context of relevant government policy and legislative requirements. These policies either require reporting of housing-related data by local authorities, or the use of such data to assist in meeting policy requirements. The main policies and legislative requirements are summarised in the following sub-sections.

2.1 Housing Act 2004

The Housing Act 2004[7] requires local housing authorities to review housing statistics in their district. The requirements of the Act are wide-ranging and also refer to other legislation which between them covers the following:

- Dwellings that fail to meet the minimum standard for housings (i.e. dwellings with HHSRS category 1 hazards)
- Houses in Multiple Occupation (HMOs)
- Selective licensing of other houses
- Demolition and slum clearance
- The need for provision of assistance with housing renewal
- The need to assist with adaptation of dwellings for disabled persons

2.2 Key housing strategy policy areas and legislation

2.2.1 Private rented sector

In the report "Laying the Foundations: A Housing Strategy for England"[8] Chapters 4 and 5 focus on the private rented sector and empty homes.

New measures are being developed to deal with rogue landlords and to encourage local authorities to make full use of enforcement powers for tackling dangerous and poorly maintained dwellings. The report encourages working closely with landlords whilst still operating a robust enforcement regime (e.g. Landlord Forums and Panels across the country).

There has been significant growth in the private rented sector in Ealing in the 10 years between 2001 and 2011 - from 16% of the total stock in 2001 to 29% in 2011[9] - so that 13% of the stock has changed over that time period to now be private rented. This is higher than the change of 9% seen in England as a whole. The analysis for this current report estimates that 33% of the stock in Ealing is now privately rented, implying a further increase since 2011.

[8] Laying the Foundations: A Housing Strategy for England, CLG, 2011

[9] https://www.ons.gov.uk/census#censusdataandbackground

2.2.2 Health inequalities

The Government's white paper "Choosing Health"[10] states that the key to success in health inequalities will be effective local partnerships led by local government and the NHS working to a common purpose and reflecting local needs. Housing is a key determinant of health, and poor housing conditions continue to cause preventable deaths and contribute to health inequalities[11]. An example in this area is the work carried out by Liverpool City Council in partnership with Liverpool Primary Care Trust – the "Healthy Homes Programme". This has identified over 3,800 hazards and led to an estimated £4.8 million investment by landlords, delivering sustainable health improvements and enhancing community wellbeing.

2.2.3 Integrated care

It has been recognised by central government that to fully address the health needs of the population, services need to become more integrated and there needs to be better communication between different providers. Housing is a key aspect of this:

"Many people with mental and physical disabilities, complex needs, long-term conditions and terminal illness also need to access different health care, social care, housing and other services, such as education, and often simultaneously"[12].

It is therefore essential that departments providing or regulating housing work with other council departments and health organisations to provide services that are integrated and take full account of the needs of the individual.

2.2.4 Public Health Outcomes Framework

The Public Health Outcomes Framework "Healthy lives, healthy people: Improving outcomes and supporting transparency"[13] sets out desired outcomes for public health and how they will be measured. Many of the measurements have links to housing, some of the more relevant being:

- Falls and injuries in over 65's
- Fuel poverty
- Excess winter deaths

There have been minor indicator changes for 2019-2022, incorporating moderate to severe falls

2.2.5 Joint Strategic Needs Assessment (JSNA) and Joint Health and Wellbeing Strategies

The JSNA and joint health and wellbeing strategy allow health and wellbeing boards to analyse the health needs of their local population and to decide how to make best use of collective resources to achieve the priorities that are formed from these. The Department of Health document "Joint Strategic Needs Assessment and joint health and wellbeing strategies explained - Commissioning for populations" says

[10] Choosing Health: Making healthy choices easier, Department of Health, 2004

[11] The health impacts of poor private sector housing, LACORS, 2010

[12] Integrated Care: Our Shared Commitment, Department of Health, 2013

[13] Healthy lives, healthy people: Improving outcomes and supporting transparency, Department of Health, 2013

"This will ensure better integration between public health and services such as housing and education that have considerable impact on the wider determinants of health"[14].

2.2.6 Energy Act 2011

The Energy Act 2011 requires that from 2016 reasonable requests by tenants for energy efficiency improvements will not be able to be refused. Furthermore, since 1 April 2018 it became unlawful for landlords to grant a new tenancy or renew an existing tenancy for a property that does not reach a minimum energy efficiency standard (MEES) of Energy Performance Certificate rating band E[15]. While there will be various caveats to these powers, they provide a new minimum standard for rented accommodation. If the EPC rating is an F or G, the landlord must improve the rating to a minimum of EPC E or register an exemption (if applicable) before they are able to let the property. From 1 April 2020, the regulations will apply to all domestic rented properties regardless of whether or not there has been a change in tenancy (again exemptions may apply but these must be registered by the landlord on the PRS exemptions register).

2.2.7 Empty homes

The need to bring empty private sector dwellings back into use is a key government objective that is part of a wider strategy to tackle housing affordability. It is generally accepted that in a time of housing shortage, empty dwellings represent a wasted resource.

Empty homes brought back into use will qualify for the New Homes Bonus where, for the following 4 years, the Government will match the Council Tax raised on long term empty properties brought back into use. This was previously set at 5 years in 2017-19 and 6 years prior to that. Between 2012-15, £100 million of capital funding was available from within the Affordable Homes Programme to tackle problematic[16] empty homes. There is no longer any separate funding for empty homes under the 2015-18 Affordable Homes Programme[17]. Since 2013, councils have been able to charge a 50% premium on the Council Tax bills of owners of homes empty for 2 years or more. 291 out of 326 councils applied an empty homes premium in 2017 to 2018[18]. Furthermore, local authorities have a range of powers and incentives at their disposal to bring empty homes back into use. These include, Empty Dwelling Management Orders, Council Tax exemptions and premiums, and measures to secure the improvement of empty properties[19].

The Affordable Homes Programme was replaced by the Shared Ownership and Affordable Homes Programme (2016-2021), supporting increased home ownership and aiming to expand supply of

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[14] Joint Strategic Needs Assessment and joint health and wellbeing strategies explained: Commissioning for populations, Department of Health, 2011

[15] https://www.gov.uk/government/publications/the-private-rented-property-minimum-standard-landlord-guidance-documents

[16] Properties that are likely to remain empty without direct financial support from government.

[17] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/343896/affordable-homes-15-18-framework.pdf

[18] https://www.gov.uk/government/news/government-boosts-councils-powers-to-help-bring-empty-homes-back-into-use

[19] https://commonslibrary.parliament.uk/research-briefings/sn03012/

affordable homes in England. A total of £4.7 billion is available for the development of Shared Ownership and other affordable homes.[20]

There are a number of issues in dealing with private sector vacant dwellings including the transient nature of vacant dwellings and their difficulty of identification. Properties are being continually bought and sold, let and modernised, which means that at any given time a proportion of the stock will be naturally vacant. The only dwellings that tend to be of most interest to local authorities are those that are not turning over in the normal way.

Whilst the data provided by this project cannot necessarily assist with the actual identification of empty homes, the HSCD would be the logical place for such information to be stored should it be gathered from other sources.

The latest available information for Ealing for 2019, collected by MHCLG[21], identifies 2,595 vacant dwellings across all tenures. This represents a vacancy rate of approximately 2% in Ealing. In 2018 the number of vacant dwellings was 4,198, and 5 years ago in 2014 the figure was 2,529. Furthermore, around 516 (>1%) dwellings are long-term vacant (6 months or more) in Ealing (2019 figures).

2.3 Other policy areas

The following policy areas, whilst not directly relating to environmental health services, will have an effect on demand and local authorities will need to be aware of the possible impact in their area.

2.3.1 The Housing and Planning Act 2016

The Housing and Planning Act 2016[22] introduces legislation for government to implement the sale of higher value local authority homes, starter homes, pay to stay and a number of other measures, mainly intended to promote home ownership and boost levels of housebuilding in England.

The Act also includes a package of measures to help tackle rogue landlords in the private rented sector. This includes:

- Allowing local authorities to apply for a banning order to prevent a particular landlord/letting agent from continuing to operate where they have committed certain housing offences
- Creating a national database of rogue landlords/letting agents, which will be maintained by local authorities
- Allowing tenants or local authorities to apply for a rent repayment order where a landlord has committed certain offences (for example continuing to operate while subject to a banning order or ignoring an improvement notice). If successful, the tenant (or the authority if the tenant was receiving universal credit) may be repaid up to a maximum of 12 months' rent
- Introducing a new regime giving local authorities an alternative to prosecution for offences committed under the Housing Act 2004, including all HMO offences. Effectively, local authorities will have a choice whether to prosecute or impose a penalty with a maximum fine of £30,000. The local authority can also retain the money recovered, which is not currently the case with fines imposed in the magistrates' court

[20] https://www.gov.uk/government/collections/shared-ownership-and-affordable-homes-programme-2016-to-2021-guidance

[21] https://www.gov.uk/government/collections/dwelling-stock-including-vacants

[22] http://www.legislation.gov.uk/ukpga/2016/22/contents/enacted/data.htm

2.3.2 The Welfare Reform and Work Act 2016 and the Welfare Reform Act 2012

The Welfare Reform and Work Act 2016[23] gained royal assent in March 2016. The Act introduces a duty to report to Parliament on progress made towards achieving full employment and the three million apprenticeships target in England. The Act also ensures reporting on the effect of support for troubled families and provision for social mobility, the benefit cap, social security and tax credits, loans for mortgage interest, and social housing rents. These include the following:

- Overall reduction in benefits – a four year freeze on a number of social security benefits
- Benefit cap reduction – the total amount of benefit which a family on out of work benefits can be entitled to in a year will not exceed £20,000 for couples and lone parents, and £13,400 for single claimants, except in Greater London where the cap is set at £23,000 and £15,410 respectively
- Local Housing Allowance rent cap – this is the locally agreed maximum benefit threshold for a dwelling or household type within a defined geographical area. Therefore, if rises in rent outstrip growth in income, renters may find it increasingly difficult to pay
- A 1% reduction in social rents per year for 4 years to reduce the housing benefit bill

In addition, the Welfare Reform Act 2012[24] (which is in parts amended by the 2016 Act discussed above) covers areas of environmental health services – in particular the sections relating to the under occupation of social housing, and the benefit cap. Whilst this will mainly affect tenants in the social rented sector it will undoubtedly have an impact on private sector services. Social tenants may find themselves being displaced into the private sector, increasing demand in this area, and the tenants of Registered Providers (RP's) and some private landlords may have greater trouble affording rent payments. If tenants are in arrears on their rental payments then authorities may be met with reluctance from landlords when requiring improvements to properties.

2.3.3 Localism Act 2011

The Localism Act allows social housing providers to offer fixed term, rather than secure lifetime, tenancies. As with the Welfare Reform Act, this has a greater direct impact on the social rented sector, however, there is some concern this may lead to greater turnover of tenancies meaning such that some traditional social tenants may find themselves in the private rented sector.

Both of these policy changes above may increase the number of vulnerable persons in private sector properties. If this occurs any properties in this sector in poor condition are likely to have a far greater negative impact on the health of those occupiers.

2.3.4 Potential increase in private rented sector properties

Policies such as the Build to Rent and the New Homes Bonus are aimed at increasing the supply of properties. As the private rented sector is already growing, it is reasonable to assume that many of the new properties being built will be rented to private tenants. Local authorities will need to be aware of the potential impact on the demand for their services and how their perception of their local area may have to change if large numbers of properties are built.

[23] http://www.legislation.gov.uk/ukpga/2016/7/contents/enacted

[24] http://www.legislation.gov.uk/ukpga/2012/5/contents/enacted

2.4 Local Authority Housing Statistics (LAHS)[25] and EPC ratings

The purpose of these statistics is twofold – firstly to provide central government with data with which to inform and monitor government strategies, policies and objectives as well as contributing to national statistics on housing, secondly, to the local authorities themselves to help manage their housing stock. Local authorities are required to complete an annual return which covers a wide range of housing-related issues. Of particular relevance to this current project is "Section F: Condition of dwelling stock" which, amongst other things, requests the following information:

- Estimates of the number of HMOs and the number of mandatory licensable HMOs

Whilst the LAHS no longer requires reporting of total number of dwellings and number of private sector dwellings with category 1 HHSRS hazards and the estimated costs of mitigating these, this information is still of use to understand the extent of these hazards within a local authority.

The LAHS no longer requires reporting of average EPC ratings of the private sector stock and the proportion below a certain rating; however, this information remains pertinent due to the Energy Act 2011. Under this act, from 1 April 2018 landlords must ensure that their properties meet a minimum energy efficiency standard when they grant a tenancy to new or existing tenants - which has been set at band E [26, 27]. From 1 April 2020, landlords can no longer continue letting a property which is already let if it has an EPC rating of F or G[28]. Furthermore, from 1 April 2016, tenants in F and G rated dwellings may legally request an upgrade to the dwelling to a minimum of a band E. Results relating to LAHS statistics and EPC ratings can be found in **Section 4.2**.

2.5 The Energy Company Obligation (ECO)

The Energy Companies Obligation (ECO) requires energy companies to assist in the installation of energy efficiency measures in Great Britain to low income and vulnerable households or those living in hard-to-treat (HTT) properties. Under the ECO, energy companies are obliged to meet targets expressed as carbon or costs saved. There have been several ECO schemes to date:

- ECO1 - ran from January 2013 to March 2015
- ECO2 - launched on 1 April 2015 and ended on 31 March 2017
- ECO2t - was an 18 month extension to the ECO2 scheme until September 2018[29, 30] as a transition period between the end of ECO2 and a new scheme.

[25] https://www.gov.uk/government/publications/completing-local-authority-housing-statistics-2012-to-2013-guidance-notes

[26] http://www.legislation.gov.uk/uksi/2015/962/contents/made

[27] Although landlords will still be able to rent out F and G rated properties after this date they will not be able to renew or sign a new contract.

[28] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794253/domestic-prs-minimum-standard-guidance.pdf

[29] Energy Company Obligation (ECO): Help to Heat: https://www.gov.uk/government/consultations/energy-company-obligation-eco-help-to-heat

- ECO3[31]- launched in October 2018 and will run for 3.5 years to the end of March 2022

Current scheme – ECO3

ECO3 has 4 phases terminating in March of each year (2019-2022). The scheme focusses on Affordable Warmth (the Carbon Emissions Reduction Obligation – CERO – has been removed) so that low income and vulnerable households are the recipients of the main benefits. The scope of the Affordable Warmth group will be expanded to include other benefits (e.g. Child Benefit, Personal Independence Payment, etc.).

In terms of measures and improvements, the focus is on replacing electric storage heaters with central heating, improving 17,000 solid wall dwellings every year, replacing broken heating systems (maximum of 35,000 per year), encouraging the replacement of heating systems only when also installing certain types of insulation. In addition, Renewable Heat Incentive measures would not be eligible under ECO3, and suppliers will be able to meet up to 10 – 20% of their obligation through “innovative measures”.

Energy companies can also use the local authority Flexible Eligibility mechanism to achieve up to 25% of their obligation – allowing councils to outline personal criteria to maximise inclusion of vulnerable people in funding for domestic heating and insulation upgrades.

The results for the basic energy efficiency variables are covered in this report and assist in the identification of dwellings which may benefit from energy efficiency improvements. Such information also provides a valuable contribution to the evidence base increasingly being required to support competitive funding bids to central government for housing improvements.

2.6 The Green Homes Grant (GHG)

The Department for Business, Energy and Industrial Strategy (BEIS) has recently launched the Green Homes Grant (GHG) which enables homeowners and residential landlords to apply for up to £5,000 of funding towards the cost of installing energy efficient improvements to the home. Under the GHG, improvements can include insulation to reduce energy use or installing low-carbon heating to reduce the amount of CO_2 produced by a dwelling. The grant was launched in September 2020 and funding terminates in March 2021[32]. Furthermore, £200m of funding is available for the installation of eligible measures under the Local Authority Delivery (LAD) competition[33] to support low income households (an annual income of no more than £30,000) living in the least energy efficient properties (i.e. EPC Bands E, F or G).

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30 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/586266/ECO_Transition_Final_Stage_IA__For_Publication_.pdf

31 https://www.gov.uk/government/consultations/energy-company-obligation-eco3-2018-to-2022

32 https://greenhomesgrant.campaign.gov.uk/

33 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/919905/green-homes-grant-la-delivery.pdf

3 Overview of the BRE Dwelling Level Housing Stock Modelling approach

3.1 Overview

This section provides a simplified overview of the BRE dwelling level housing stock modelling approach. More detail on the methodology is provided in **Appendix B**.

A stock modelling approach has been developed and used by BRE for many years and dwelling level models are used to estimate the likelihood of a particular dwelling meeting the criteria for each of the Housing Standard Variables (and other outputs of interest). These outputs can then be mapped to provide the council with a geographical distribution of each of the variables which can then be used to target resources for improving the housing stock. The process is made up of a variety of data sources, calculations and models.

The models are principally informed by the Ministry of Housing, Communities and Local Government's (MHCLG) English Housing Survey (EHS)[34]. The EHS dataset is used to identify patterns in the housing stock for those which fail a given indicator, for example HHSRS. This knowledge can be applied, using statistical methods, to impute Housing Standards Variables and energy characteristics from other data available at dwelling level which cover the whole of England. To model the energy efficiency of dwellings, BRE have developed a variant of the BREDEM[35] software, named "SimpleCO_2", that can calculate energy outputs from a reduced set of input variables.

The modelled dwelling level data provided for Ealing makes significant use of the Experian UK Consumer Dynamics Database of dwelling and household indicators, as well as OS datasets as inputs to the models.

The London Borough of Ealing also provided additional sources of local data which were incorporated into the BRE Housing Stock Model and Database, as well as the EPC data, to produce an integrated housing stock model and database. The additional data provided and how it was used is as follows:

- **EPC data** – EPCs contain data on key dwelling energy characteristics (e.g. wall type and insulation, loft insulation, heating types etc.) and where these were available they were used in preference to the modelled data. It should be noted that to comply with bulk EPC data licencing requirements the EPC data is only used to inform the energy efficiency aspects of the model.
- **LLPG data –** the Unique Property Reference Number (UPRN) from the LLPG was used to uniquely identify all properties, while the address details from the LLPG were used to merge the BRE Models and the EPC data using address matching.

[34] The most recent survey used in the housing stock models is 2015.

[35] Building Research Establishment Domestic Energy Model, BRE are the original developers of this model which calculates the energy costs of a dwelling based on measures of building characteristics (assuming a standard heating and living regime). The model has a number of outputs including an estimate of the SAP rating and carbon emissions.

- **Tenure data –** the council provided lists of addresses subject to mandatory HMO licensing, addresses of private rented properties eligible for city-wide selective licensing, and a combined list of addresses owned by social landlords. This data was used to inform the tenure variable.
- **Benefits data –** this provides a list of addresses in receipt of various benefits. This was matched into the BRE Model using the UPRN and these addresses were assigned to low income households. The BRE Low Income Households Model was then used to assign the remaining low income households since housing and council tax reductions are only a proportion of total low income households.
- **HMO data –** the council provided a list of HMOs and additional licensed HMOs which were added to the modelled HMOs. Additional licensed HMOs are flagged within the HSCD so they can be identified. The list provided also included mandatory HMOs which were assigned as such within the model, and "Temp Exemption Notice (HMO)" which were assigned as HMOs.
- **Selective Licensing records** – a list of properties which are subject to selective licensing were also supplied and these were used to inform tenure. These properties are also flagged within the HSCD so they can be identified.

Figure 1 shows a simplified flow diagram of the overall BRE housing stock modelling approach and how the additional data is incorporated to produce the integrated Housing Stock Condition Database (HSCD).

The process is made up of a series of data sources and models which, combined with various imputation and regression techniques and the application of other formulae, make up the final database. The database is essentially the main output of the modelling and provides information on the Housing Standards Variables and other data requirements (e.g. energy efficiency variables). More detailed information on the data sources and models is provided in **Appendix B**, but to summarise:

The data sources are:
EHS, EPC, Experian, Ordnance Survey (OS) MasterMap, other local data (if available)

The Models are:
SimpleSAP, Fuel Poverty, HHSRS (all hazards, falls hazards and excess cold), Disrepair and Low Income Households.

The data sources and models are linked as shown in the flow diagram and the modelling process itself can be divided into "energy inputs" and "other inputs", which are summarised as follows:

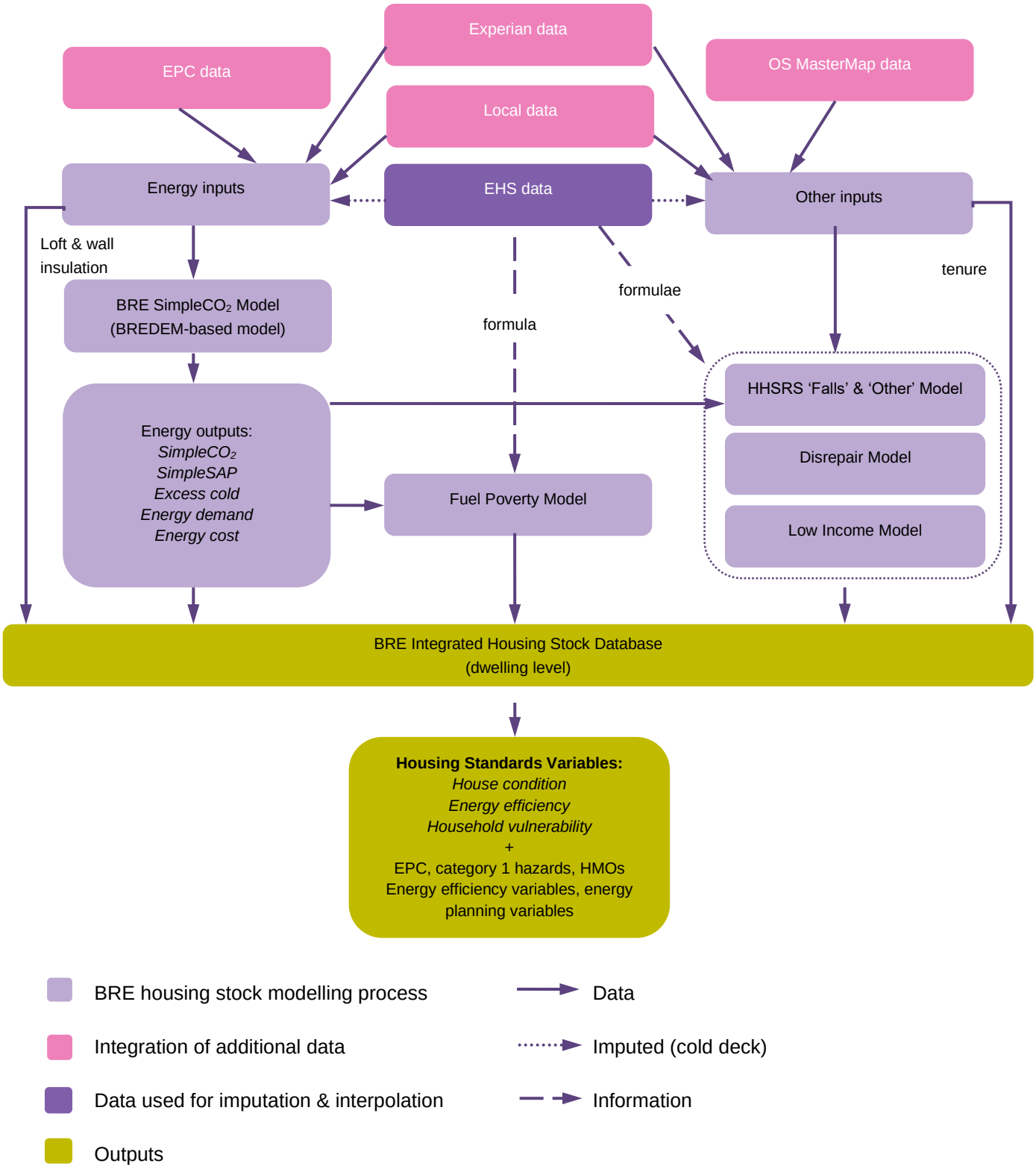
Energy inputs - are developed from Experian, EPC and other local data sources (if available). The EHS data is used to impute (using cold deck imputation[36]) and interpolate where there are gaps in the data. The "energy inputs" are then fed into the SimpleCO_2 Model to produce the "energy outputs" for the database plus information on excess cold for the HHSRS Model and information on energy costs for the Fuel Poverty Model.

Other inputs – are developed from Experian, OS MasterMap and other local data sources. The EHS data is used to impute (using cold deck imputation[36]) and interpolate where there are gaps in the data. The "other inputs" are then fed into the HHSRS, Disrepair, and Low Income Models (note that tenure data

[36] Cold deck imputation is a process of assigning values in accordance with their known proportions in the stock.

is fed directly into the database). Information from the EHS also feeds into the Fuel Poverty, HHSRS, Disrepair and Low Income Models.

Figure 1: Simplified flow diagram of overall BRE housing stock modelling approach (N.B. the EHS data is only used to inform the mathematical algorithms of the model – it does not provide data)



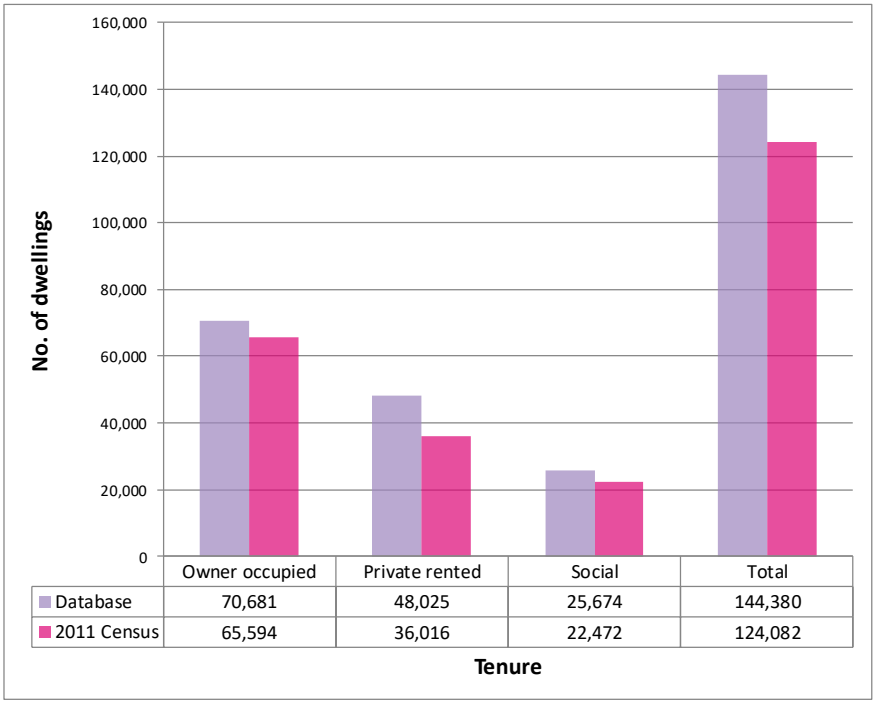
3.2 Breakdown of the housing stock by tenure - validation

Providing the results split by tenure is useful since it can have an effect on how resources and improvement policies are targeted. This report is particularly focussed on private sector stock which is made up of owner occupied and private rented dwellings. The remainder of the housing stock consists of social housing.

The total number of dwellings in Ealing from the integrated housing stock condition database is based on LLPG data; therefore the model is based on this value. The tenure split within the integrated database is derived from the purchased Experian tenure variable for addresses where tenure has not been supplied by the council.

Since it is possible for private rented dwellings to become owner occupied and vice versa relatively easily, it is difficult to accurately predict the actual tenure split at any given point in time. A validation process was undertaken to compare the tenure split from the database to the 2011 Census figures[37]. The results of the validation exercise show the differences between the tenure split from the database compared to the Census figures. There has been a noticeable increase in the size of the stock, mainly in the private rented sector and to a lesser degree in the owner occupied and social sectors (see **Figure 2**). Furthermore, **Maps 1** and **2** show the geographical distributions of the private rented sector which look similar, again giving confidence that the integrated database provides a good overview of the housing stock in Ealing.

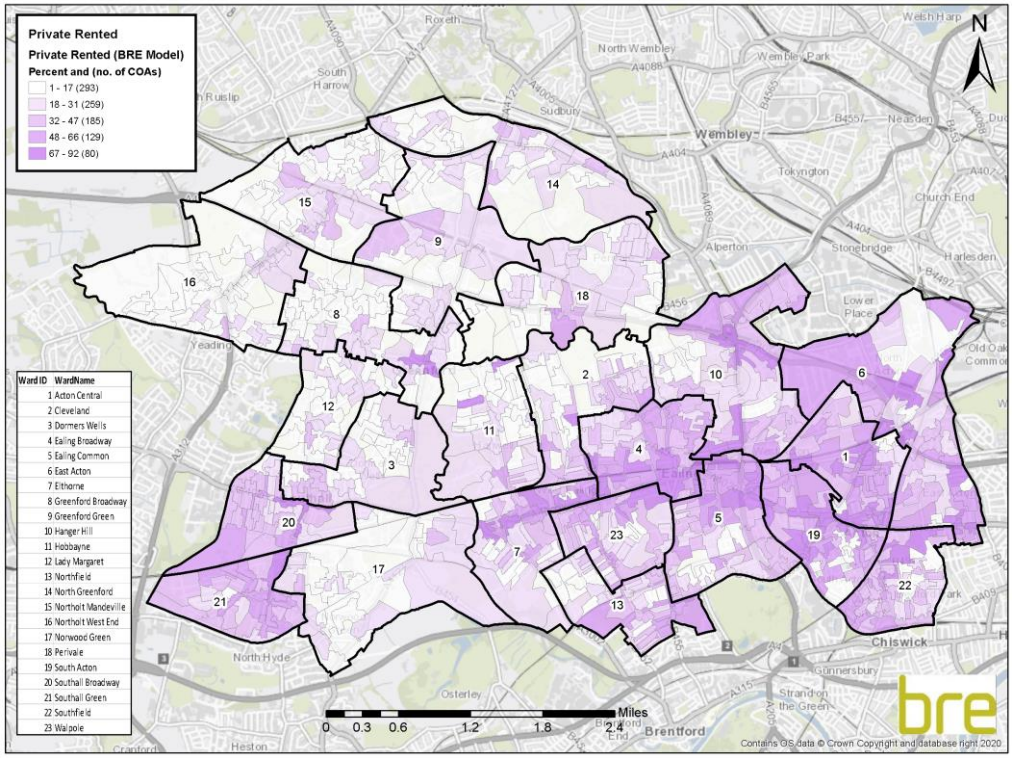
Figure 2: Tenure split – comparison of BRE Housing Stock Condition Database outputs with 2011 Census figures for Ealing



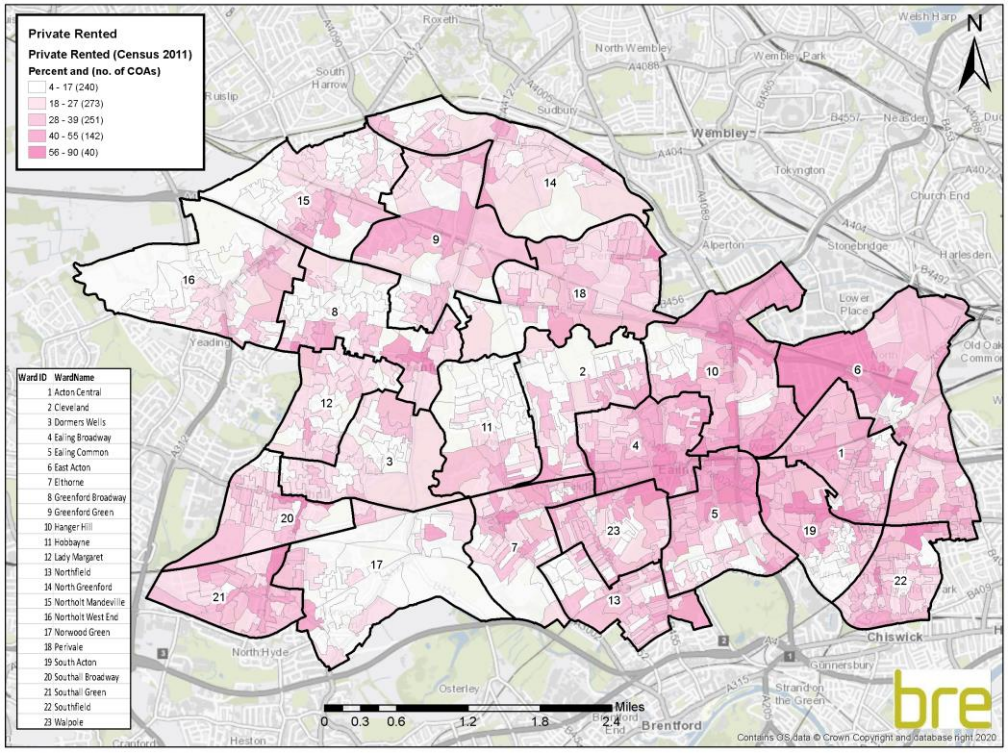
	Owner occupied	Private rented	Social	Total
Database	70,681	48,025	25,674	144,380
2011 Census	65,594	36,016	22,472	124,082

[37] http://www.ons.gov.uk/ons/datasets-and-tables/index.html

Map 1: Distribution of estimated percentage of private rented dwellings in Ealing – based on database



Map 2: Distribution of estimated percentage of private rented dwellings in Ealing – based on 2011 Census Data (Neighbourhood Statistics)



3.2.1 Other national datasets relating to tenure

In addition to the Census data there are other national datasets available which provide information on tenure; these are MHCLG returns[38] and Office for National Statistics (ONS) data[39]. These datasets are not used directly in the model but are reported here for the purposes of comparison.

The MHCLG returns provide estimates of the tenure split by private sector and social sector only, with the former being based on projections from the 2011 Census as a starting point, and the latter being based on Local Authority Housing Statistics. The tenure split used in the BRE Housing Stock Model is compared to this at an early stage of the project in order to ensure the tenure split is consistent[40].

The ONS data provides subnational (local authority level) data on the dwelling stock broken down into tenure. The ONS split between owner occupied and private rented stock is based on their Annual Population Survey (APS)[41] which is then benchmarked to the MHCLG returns. The APS is based on "persons who regard the sample address as their main address and also those who have lived in the dwelling for more than 6 consecutive months, even if they do not regard this as their principal dwelling". This methodology may under-estimate the proportion of private rented dwellings for several reasons:

1. By only including those people who have lived in a dwelling for more than 6 consecutive months, the number of private rented households may be under-estimated as there tends to be a higher turnover in this sector.
2. By only including persons who regard the sample address as their main address there are two groups where this may have an impact on the estimated figures:
    a. Students renting away from home who assume their parents' address to be their main residence.
    b. Commuter areas where households may have a city flat during the week and also have a suburban family home which they class as their first residence. Commuter towns close to large cities may also have higher levels of private rented stock with a high turnover of tenants near rail stations for example.

In addition, the ONS dataset uses EHS data but this is limited to using the occupancy rate to allow for vacant dwellings as their APS is based on individuals and therefore does not account for vacant dwellings.

[38] https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants

[39] https://www.ons.gov.uk/peoplepopulationandcommunity/housing/articles/researchoutputssubnationaldwellingstockbytenureestimatesengland2012to2015/2017-12-04#methodology

[40] This comparison is checked early on in the project through email correspondence with the authority.

[41] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/annualpopulationsurveyapsqmi

It is important to note that the ONS data is not an official statistic and that a disclaimer[42] must be used when reproducing the data (note that the "***dwelling stock by tenure***" in the disclaimer refers to the MHCLG returns data).

Table 2 shows the latest tenure splits from the MHCLG data for Ealing. Since the ONS data is benchmarked to the MHCLG returns, the figures for the private sector stock match. The BRE data estimates a slightly higher proportion of private rented properties than the ONS data (33% compared with 28%). The slightly higher proportion estimated by the BRE model could be due to student renters and commuters in this area as a result of the University of West London and transport links. The presence of these two factors means that these types of householders may be using their parents' home address as their main address or own a second property in the area which is not classed as their main address.

As previously mentioned, the proportion of private rented stock in Ealing from the 2011 Census figures[43] was 29%, and the BRE Database figure of 33% ties in with this given that there is more likely to have been an increase in the private rented stock since 2011.

Table 2: Comparison of MHCLG, ONS and BRE Database figures on tenure split for Ealing

Tenure	Number of dwellings			% of all stock		
	2017 MHCLG	2017 ONS	BRE Database	2017 MHCLG	2017 ONS	BRE Database
Owner occupied	108,500	71,567	70,681	82%	54%	49%
Private rented		36,933	48,025		28%	33%
Social	23,590	-	25,674	18%	-	18%

N.B. MHCLG data does not break down private sector into owner occupied and private rented stock and ONS data does not provide an estimate for social stock

[42] ONS Disclaimer: *"We have published these Research outputs to provide an indication of the tenure breakdown of dwellings within the private sector at the subnational level. Research Outputs are produced to provide information about new methods and data sources being investigated. Official statistics on private dwellings by tenure are currently only available at the country level. Statistics on* ***dwelling stock by tenure***[38] *are available for local authorities but do not provide a breakdown of owner-occupied and privately rented dwellings. These statistics are subject to marginal error as they are estimates based on a survey, therefore users should refer to the coefficient of variation (CV) and confidence intervals when making interpretations."*

[43] http://www.ons.gov.uk/ons/datasets-and-tables/index.html

4 Results from the BRE Dwelling Level Housing Stock Models and Housing Stock Condition Database (HSCD)

As described in the previous section, the housing stock modelling process consists of a series of different stock models with the main output being the HSCD. The results in this section have been obtained from interrogating the database at the level of the local authority as a whole to give a useful overview for Ealing. Information at ward level, however, is provided in the maps, in **Section 4.2.4** and can also be obtained from the HSCD which has been supplied as part of this project (see **Appendix C** for instructions). The HSCD can be interrogated at local authority, ward, Medium Super Output Area (MSOA), Lower Super Output Area (LSOA), Census Output Area (COA), postcode or dwelling level.

The first sub-section below provides a map of the wards in Ealing. The results are then displayed in the following sub-sections:

- Housing Standards Variables (and including category 2 hazards):
  - Ealing – regional and national comparisons
  - Housing Standards Variables by tenure for Ealing
  - Housing Standards Variables mapped by COA for Ealing private sector stock
  - Ward level results for the Housing Standards Variables

- Information relating to LAHS reporting and EPC ratings:
  - Category 1 hazards
  - HMOs
  - EPC ratings

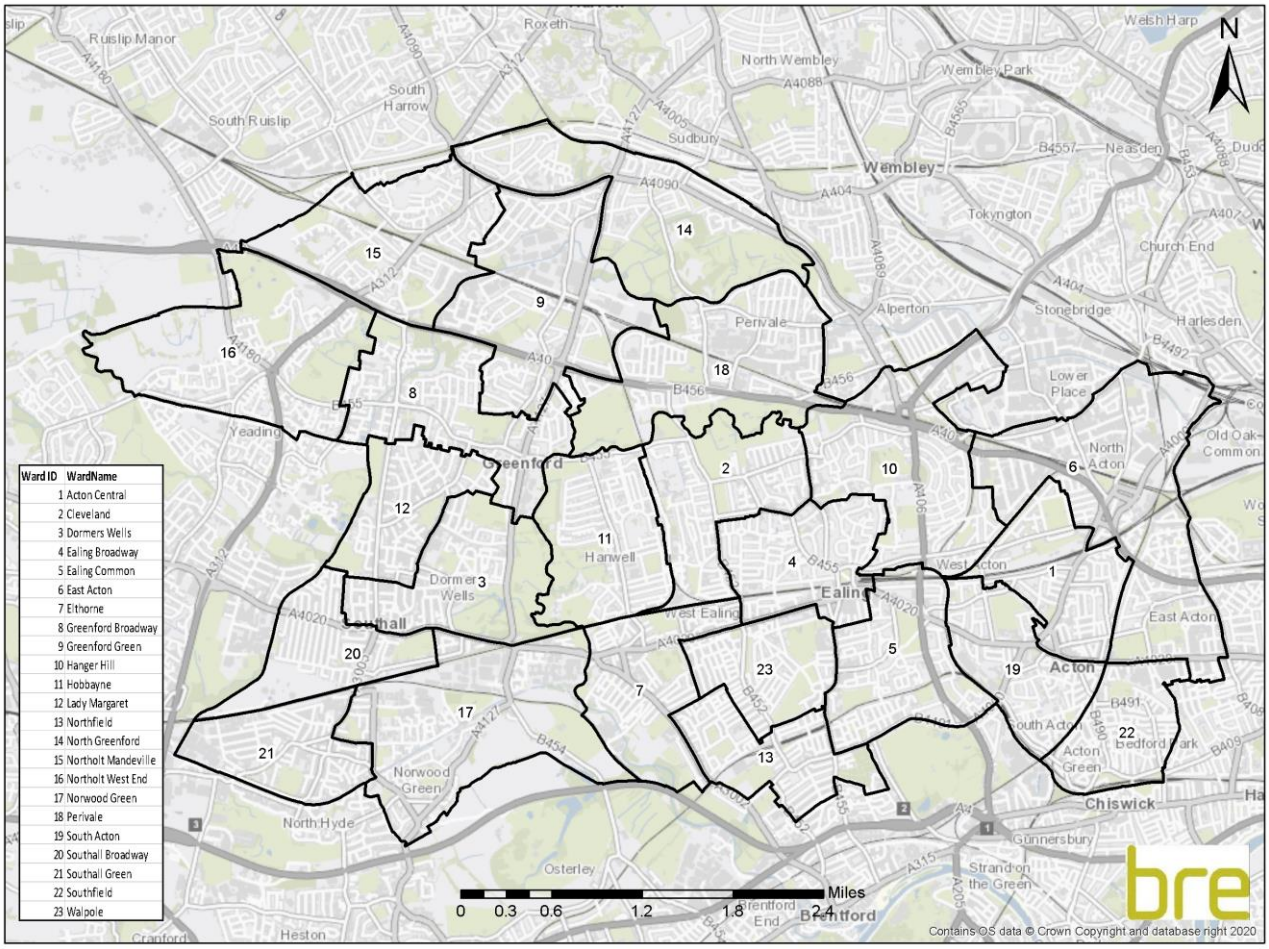
- Energy efficiency variables for Ealing (wall and loft insulation)
- Energy planning variables for Ealing
- Improvement scenarios
- Additional modelling analysis to determine the estimated potential costs required to improve SimpleSAP ratings to a) 65 and b) 75

4.1 Overview of Ealing

Map 3 below shows the 23 wards in Ealing. The data in the report is separated into wards and then further divided into Census Output Areas (COAs). These typically comprise around 125 households and usually include whole postcodes, which have populations that are largely similar. Where the COAs are smaller in size on the map this typically represents a more densely populated area since each COA represents a similar number of dwellings.

It should be noted that some residential addresses are not considered suitable for modelling and these have been removed. These include caravans and house boats which, whilst covered by the EHS, are quite uncommon, and the energy models and other key variables were not developed with dwellings such as these in mind. Residential institutions (e.g. care homes) have also been removed as it is not entirely appropriate to apply the usual models to these dwellings. The removal of these addresses may result in a COA not appearing to contain any dwellings due to the fact that all c.125 households are made up of caravans for example.

Map 3: The wards in Ealing



4.2 Housing Standards Variables

4.2.1 Ealing – regional and national comparisons

Table 3 and **Figure 3** show the results for each of the Housing Standards Variables in Ealing compared to the London region and to England (EHS 2015) and split into all stock and private sector stock. **Figure 4** shows the results of the SimpleSAP ratings.

For all stock, the performance of the housing stock in Ealing compared to the EHS England average is mixed. Ealing performs better for all hazards (9% compared to 12%), fall hazards (4% compared to 7%) fuel poverty (both definitions) and low income households (25% compared to 26%), but slightly worse for excess cold (4% compared to 3%) and disrepair (5% compared to 4%). Levels of category 2 hazards in Ealing are higher than the EHS England average (44% compared to 33%).

When comparing Ealing to the London region, Ealing performs better for low income households but notably worse for excess cold, and with similar levels for the other variables.

Comparing Ealing to the EHS England average figures for the private sector stock, Ealing performs slightly better for all hazards, falls, fuel poverty (both definitions) and low income households, but slightly worse for excess cold and disrepair and notably worse for category 2 hazards.

Compared with the regional average, private stock has similar levels of fuel poverty (both definitions) and low income households, but slightly higher levels of the other variables. This is particularly true for category 2 hazards – levels in Ealing's are estimated to be 43%, compared with to the regional average of 37%.

The average SimpleSAP ratings in Ealing (**Figure 4**) are lower than the England and regional averages, for both all stock and the private sector stock.

Table 3: Estimates of the numbers and percentage of dwellings with the presence of each of the Housing Standards Variables assessed by the Housing Stock Models and HSCD for all stock and private sector stock – Ealing compared to the London and England (EHS 2015)

Variable		All stock				Private sector stock			
		Ealing (no.)	Ealing (%)	2015 EHS Regional (%)	2015 EHS England (%)	Ealing (no.)	Ealing (%)	2015 EHS Regional (%)	2015 EHS England (%)
No. of dwellings		144,380	-	-	-	118,706	-	-	-
HHSRS category 1 hazards	All hazards	13,413	9%	7%	12%	11,782	10%	7%	13%
	Excess cold	6,024	4%	1%	3%	5,412	5%	1%	4%
	Fall hazards	5,790	4%	4%	7%	5,391	5%	4%	8%
Disrepair		7,557	5%	5%	4%	6,859	6%	5%	4%
Fuel poverty (10%)		12,602	9%	9%	10%	9,255	8%	8%	10%
Fuel poverty (LIHC)		14,685	10%	10%	11%	11,130	9%	9%	11%
Low income households		35,694	25%	28%	26%	18,928	16%	16%	17%
HHSRS category 2 hazards		63,584	44%	34%	33%	50,519	43%	37%	35%

N.B. the information on hazards refers to the number of dwellings with a hazard of the stated type. Because of this there is likely to be some overlap – for example, some dwellings are likely to have excess cold and fall hazards but this dwelling would only be represented once under 'all hazards'. The number of dwellings under 'all hazards' can therefore be less than the sum of the excess cold plus fall hazards.

Figure 3: Estimates of the percentage of dwellings with the presence of each of the Housing Standards Variables assessed by the Housing Stock Models and HSCD for all stock and private sector stock – Ealing compared to the London and England (EHS 2015)

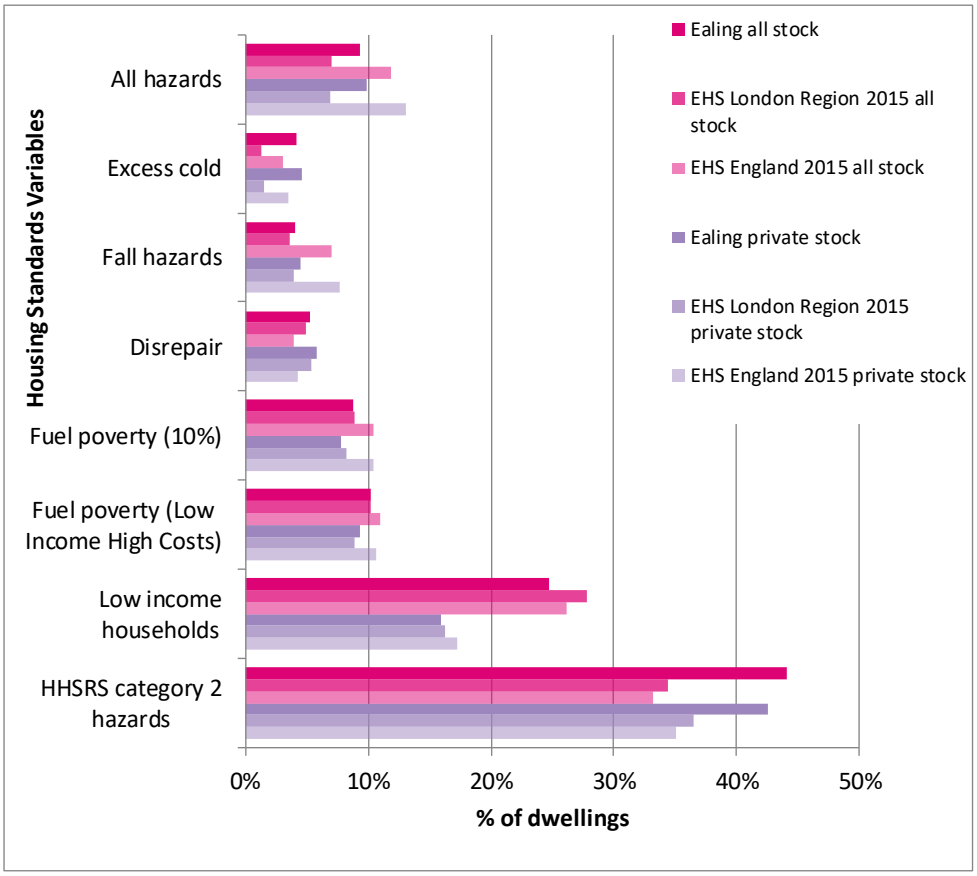
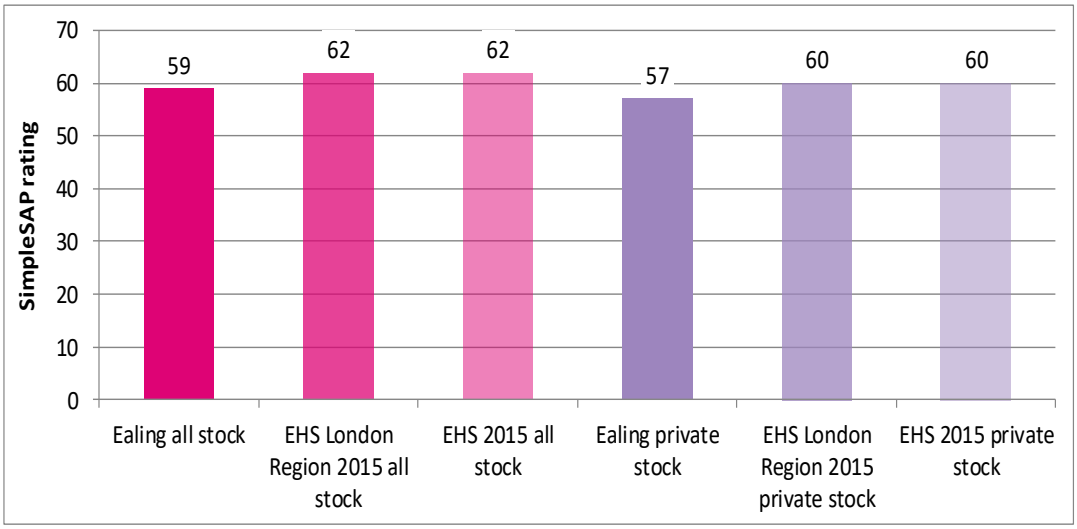


Figure 4: Average SimpleSAP ratings for all stock and private sector stock – Ealing compared to the London and England (EHS 2015)



4.2.2 Housing Standards Variables by tenure – Ealing

The private sector stock can be further split by tenure – owner occupied and private rented - with the difference between total private sector stock and total housing stock being the social housing stock. **Table 4** and **Figure 5** below show the results for each of the Housing Standards Variables split by tenure and **Figure 6** shows the SimpleSAP ratings by tenure.

The social stock is generally better than the private sector stock across the majority of variables including SimpleSAP. Social stock tends be more thermally efficient than the private stock partly due to the prevalence of flats, and partly due to being better insulated owing to the requirements placed on social housing providers, for example through the Decent Homes Programme. As would be expected, the social stock is significantly worse than the private sector stock for the low income households variable. The social tenure also shows the highest levels for both fuel poverty definitions and for category 2 hazards.

The social data should be treated with some caution as the social rented stock, particularly when largely comprising stock owned by a single landlord, is more difficult to model than the private sector. This is because the decisions of an individual property owner usually only affect a single dwelling out of the thousands of private sector stock whereas the policies and decisions of a single landlord can have a very great effect on a large proportion of the social stock. The social rented results are therefore best considered as a benchmark which takes account of the age, type, size and tenure against which the landlord's own data could be compared.

Focussing on the tenures within the private sector stock, the owner occupied sector has higher levels of all hazards, excess cold, fall hazards and fuel poverty (10% definition), but lower levels of disrepair and fuel poverty (Low Income High Costs definition). The private rented stock has a notably higher proportion of low income households compared to the owner occupied stock.

Table 4: Estimates of the numbers and percentage of dwellings with the presence of each of the Housing Standards Variables assessed by the Housing Stock Models and HSCD by tenure for Ealing

Variable		Private sector stock				Social stock	
		Owner occupied		Private rented			
		No.	%	No.	%	No.	%
No. of dwellings		70,681	-	48,025	-	25,674	-
HHSRS category 1 hazards	All hazards	7,968	11%	3,814	8%	1,631	6%
	Excess cold	4,124	6%	1,288	3%	612	2%
	Fall hazards	3,560	5%	1,831	4%	399	2%
Disrepair		3,639	5%	3,220	7%	698	3%
Fuel poverty (10%)		6,495	9%	2,760	6%	3,347	13%
Fuel poverty (LIHC)		4,989	7%	6,141	13%	3,555	14%
Low income households		7,413	10%	11,515	24%	16,766	65%
HHSRS category 2 hazards		29,375	42%	21,144	44%	13,065	51%

N.B. the information on hazards refers to the number of dwellings with a hazard of the stated type. Because of this there is likely to be some overlap – for example, some dwellings are likely to have excess cold and fall hazards but this dwelling would only be represented once under 'all hazards'. The number of dwellings under 'all hazards' can therefore be less than the sum of the excess cold plus fall hazards.

Figure 5: Estimates of the percentage of dwellings with the presence of each of the Housing Standards Variables assessed by the Housing Stock Models and HSCD by tenure for Ealing

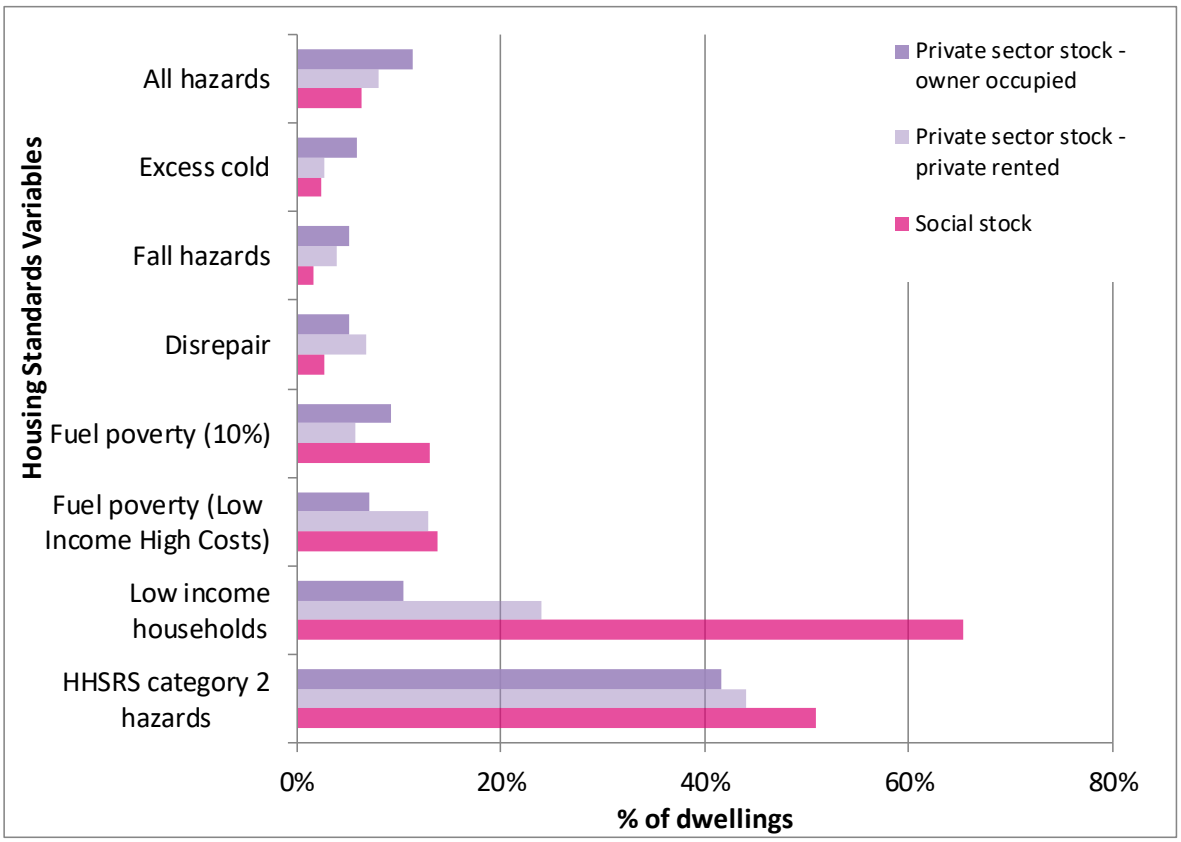
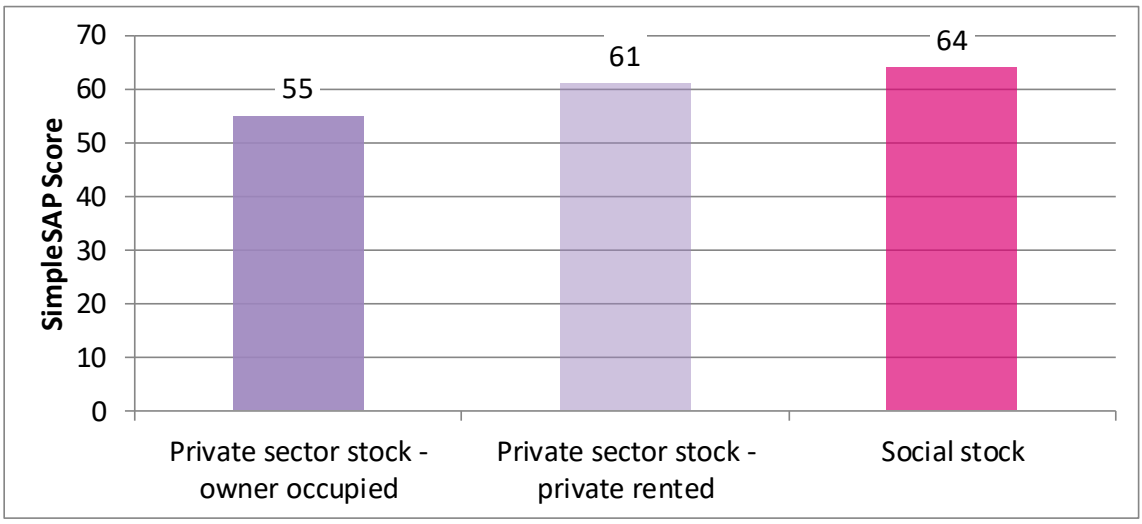


Figure 6: Average SimpleSAP ratings by tenure for Ealing



4.2.3 Housing Standards Variables mapped by Census Output Area (COA) – Ealing private sector stock

Some of the Housing Standards Variables are also provided in map form below along with a brief description of each variable[44], thus enabling quick observation of the geographical distribution of properties of interest. The maps show the percentages of private sector dwellings in each Census Output Area (COA) that are estimated to have each of the Housing Standards Variables.

The ranges shown in the map keys are defined based on the Jenks' Natural Breaks algorithm of the COA statistics[45]. The outputs in the lightest and darkest colours on the maps show the extreme ends of the range, highlighting the best and the worst areas.

Maps at COA level are provided for the following variables in **Map 4** to **Map 13** below:

- **HHSRS**
  - The presence of a category 1 HHSRS hazard
  - The presence of a category 1 hazard for excess cold
  - The presence of a category 1 hazard for falls
  - The presence of a category 2 hazard
- **Levels of disrepair**
- **Levels of fuel poverty** (Low Income High Costs and 10% definitions)
- **Low income households**
  - Dwellings occupied by low income households
  - Dwellings with a category 1 excess cold hazard that are occupied by a low income household
- **The average SimpleSAP[46] rating**

In addition, maps have been provided for HMOs, EPC ratings, energy efficiency variables (uninsulated cavity walls, solid walls, loft insulation) and energy planning variables (energy demand/cost and heat demand/cost).

These maps are extremely useful in showing the geographical distribution for single variables. Maps can also be produced for a combination of variables, such as dwellings with an excess cold hazard which are also occupied by low income households, as shown in **Map 12**.

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[44] See **Appendix A** for full definitions.

[45] The natural breaks classification method is a data clustering method determining the best arrangement of values into different classes. It is achieved through minimising each class's average deviation from the class mean while maximising each class's deviation from the means of the other groups. The method seeks to reduce the variance within classes and maximise variance between classes thus ensuring groups are distinctive.

[46] Important note: Whilst it is possible to provide "SimpleSAP" ratings from the "SimpleCO_2" software, under no circumstances must these be referred to as "SAP" as the input data is insufficient to produce an estimate of SAP or even RdSAP for an individual dwelling that meets the standards required by these methodologies.

The maps are produced at COA level, which is typically made up of around 125 households, usually including whole postcodes and having similar sized populations. Using the first map below (**Map 4**) as an example, it can be seen that each ward is split into several COAs and, in this instance, there are 22 COAs that have 21-38% of private sector dwellings estimated to have the presence of a category 1 hazard.

The maps also highlight the differences between areas, showing that the results for some areas are much worse than for others and these are the specific areas which might warrant attention. The maps also show that even within wards there can be large differences between the results at COA level.

4.2.3.1 HHSRS

The Housing Health and Safety Rating System (HHSRS) is a risk-based evaluation tool to help local authorities identify and protect against potential risks and hazards to health and safety from any deficiencies identified in dwellings. It was introduced under the Housing Act 2004[7] and applies to residential properties in England and Wales.

The HHSRS assesses 29 categories of housing hazard. Each hazard has a weighting which will help determine whether the property is rated as having a category 1 (serious) or category 2 (other) hazard[47].

The HHSRS category 1 hazards map (**Map 4**) shows that there are concentrations of high levels of category 1 hazards distributed across the area but with higher concentrations towards central Ealing and to the south of the area. The data behind the map shows that the wards with the highest levels overall are Walpole, Lady Margaret and Greenford Green. In Walpole ward, the highest areas are in the centre and east of the ward. Lady Margaret has higher levels in the centre and north east of the ward and Greenford Green ward has higher levels towards the north.

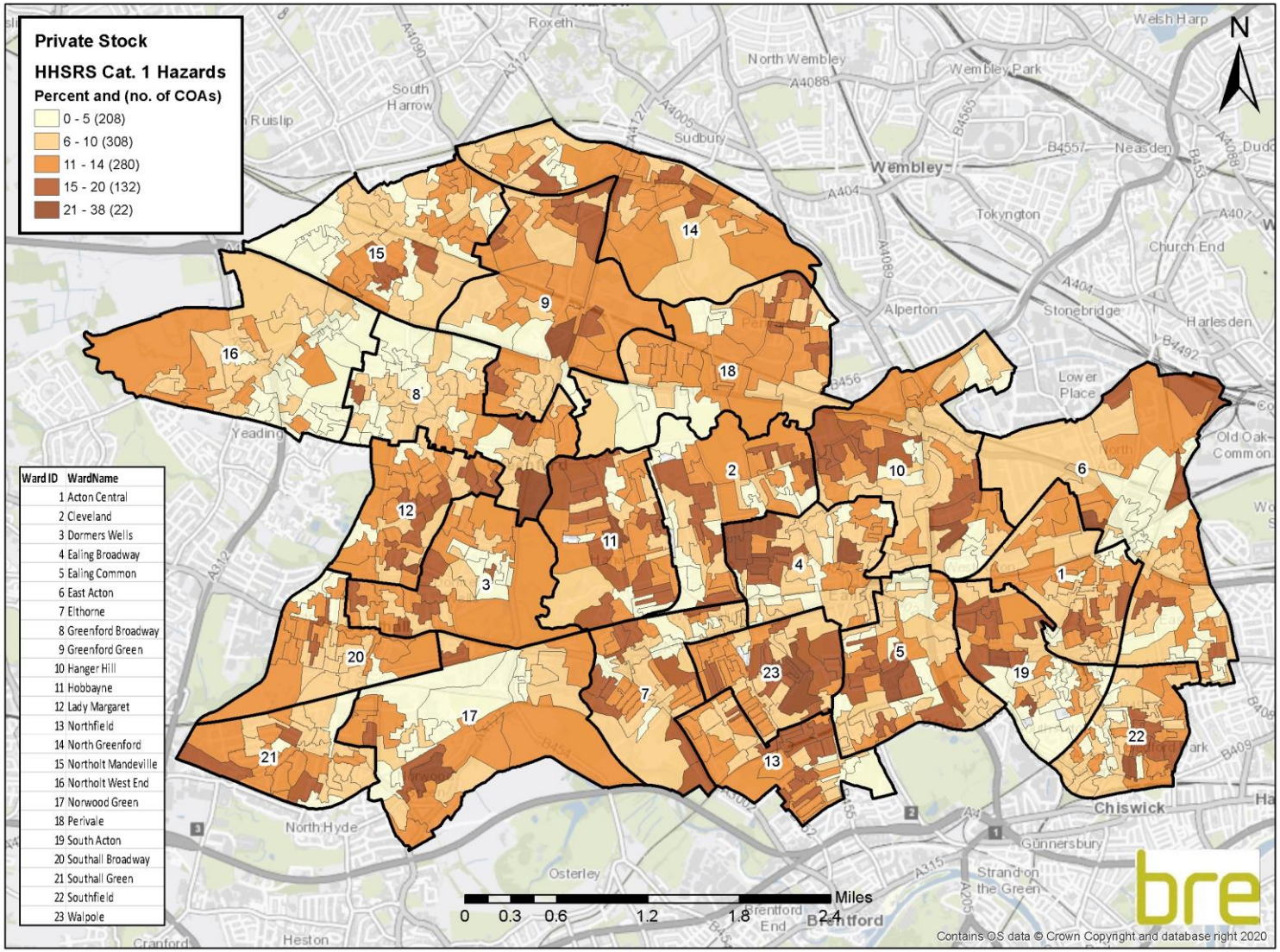
Looking at the hazard of excess cold in Ealing there are again higher concentrations distributed across the area – see **Map 5**. The data behind the map shows that the highest levels overall are in Greenford Green, Hobbayne and Lady Margaret but there are also similar levels elsewhere – for example in the wards of Ealing Broadway (particularly to the north west and west of this ward) and Walpole (particularly to the centre and east of this ward).

The distribution of fall hazards is shown in **Map 6** which indicates that the high concentrations are distributed across the borough. The data behind the map shows that the wards with the highest levels of fall hazards are Walpole, Northfield and Lady Margaret. Some of the highest levels are scattered across Walpole ward, to the north, south and a western corner of Northfield ward, and to the centre and south of Lady Margaret ward. There are COAs with higher levels of fall hazards elsewhere; for example a noticeable COA in the centre of Dormers Wells ward and to the west of Elthorne ward.

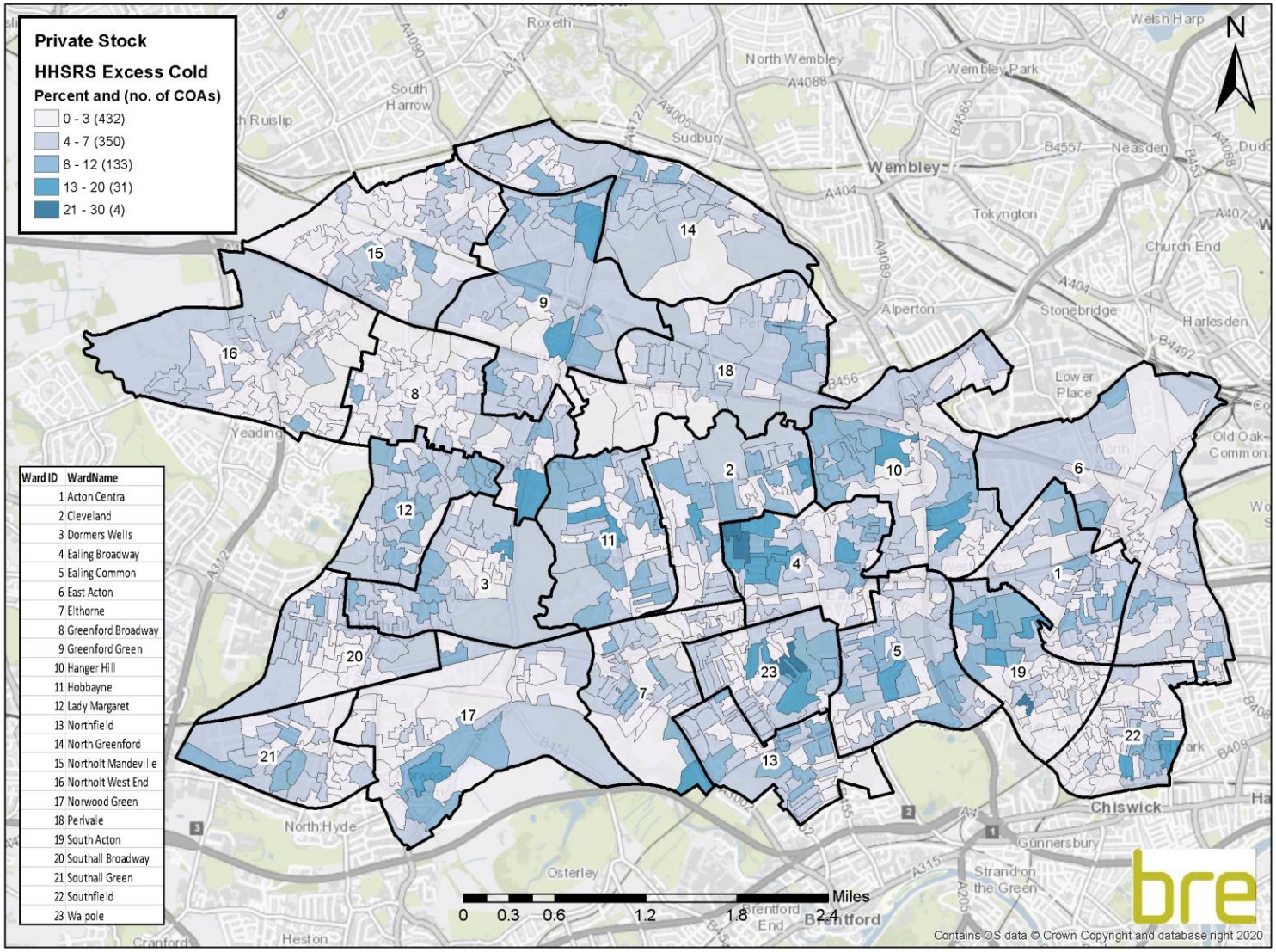
The distribution of category 2 hazards is shown in **Map 7**. There are concentrations of high levels of category 2 hazards distributed across the borough; for example, across much of Walpole ward, central COAs of Northfield ward, to the west of Southall Broadway ward and to the north east of East Acton ward.

[47] Housing Health and Safety Rating System Operating Guidance, ODPM, 2006

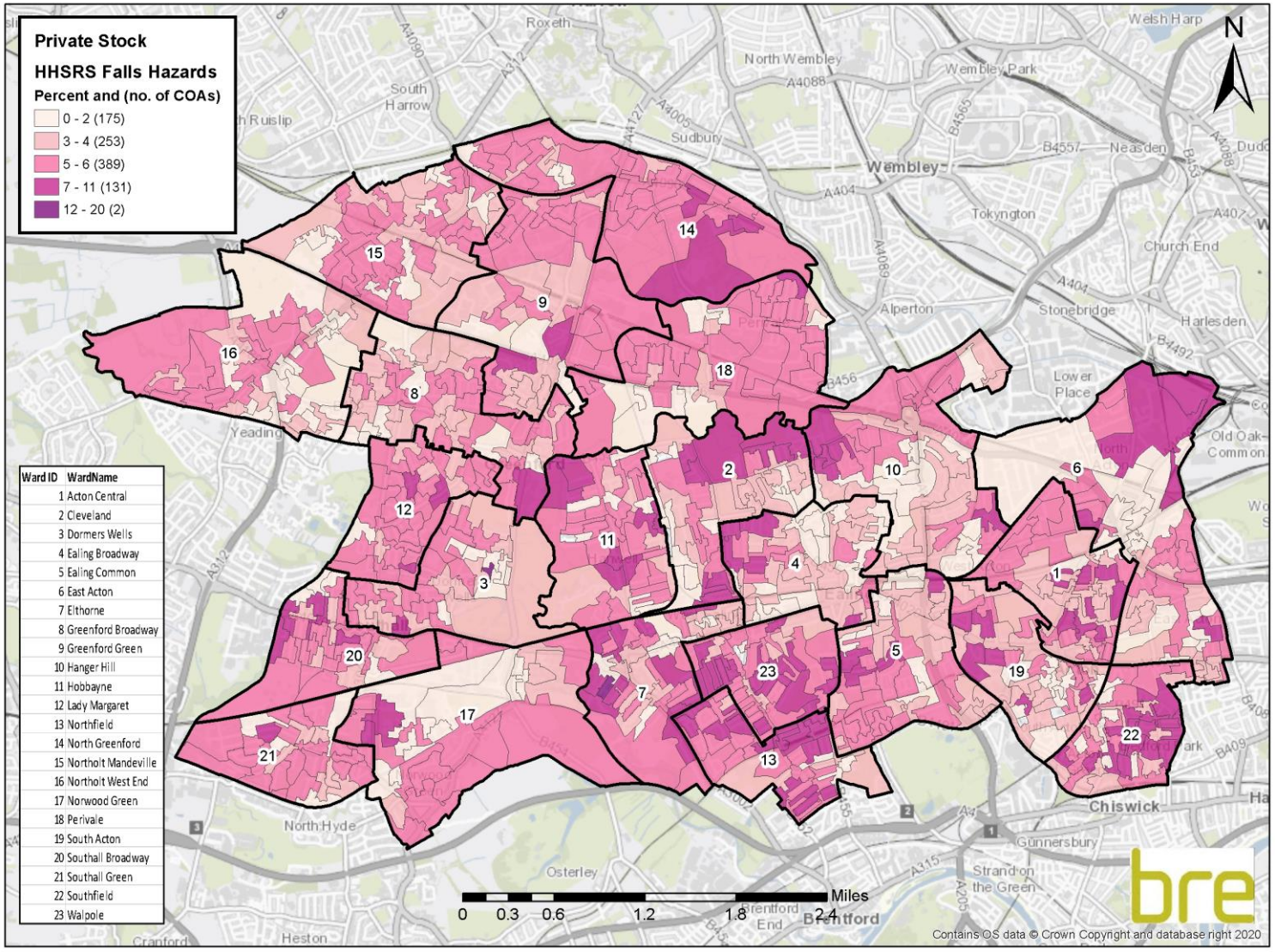
Map 4: Percentage of private sector dwellings in Ealing with the presence of a HHSRS category 1 hazard



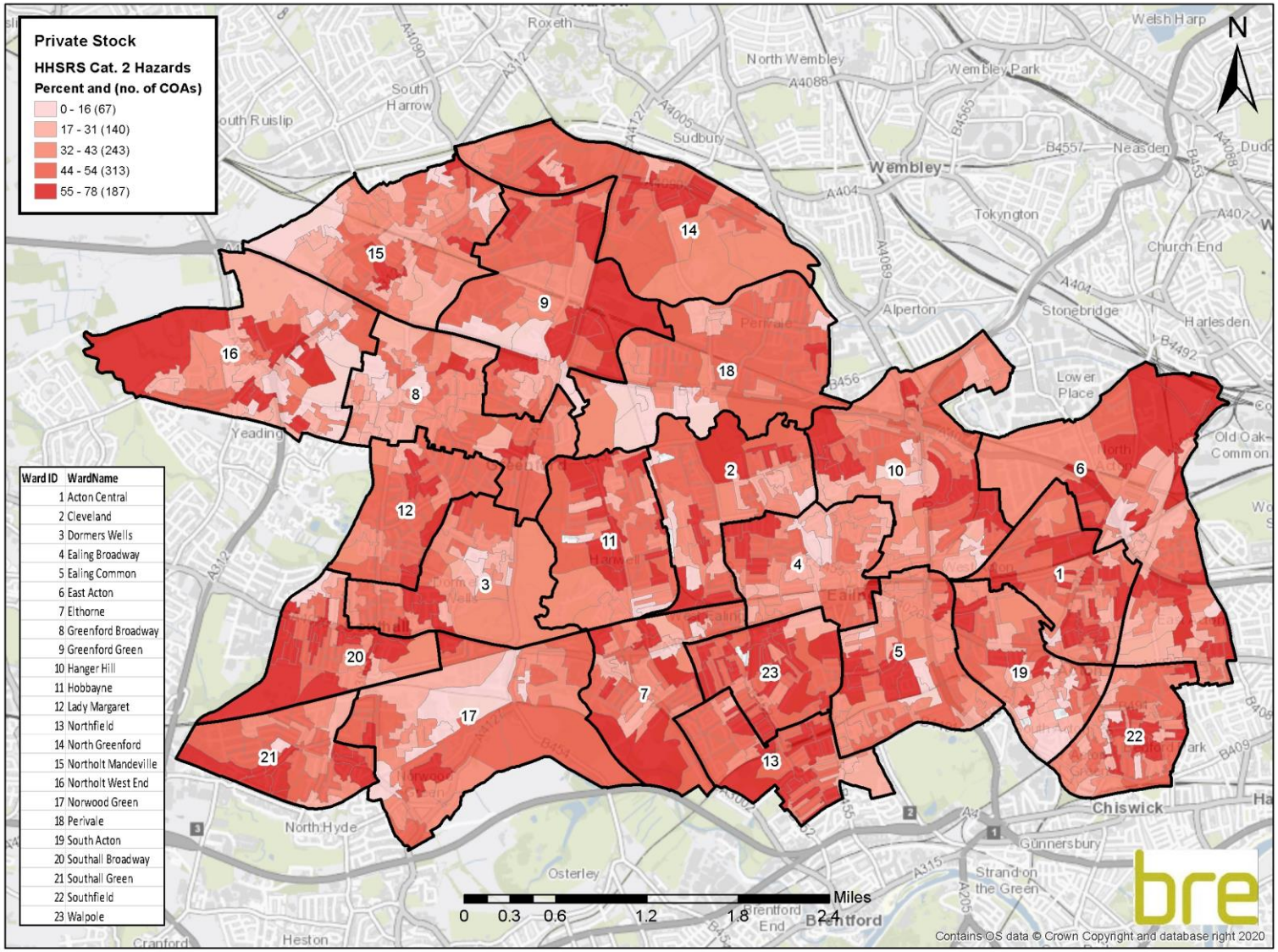
Map 5: Percentage of private sector dwellings in Ealing with the presence of a HHSRS category 1 hazard for excess cold



Map 6: Percentage of private sector dwellings in Ealing with the presence of a HHSRS category 1 hazard for falls



Map 7: Percentage of private sector dwellings in Ealing with the presence of a HHSRS category 2 hazard



4.2.3.2 Disrepair

The disrepair variable used in this report is based on the disrepair component of the Decent Homes Standard[48,49]. A dwelling fails the disrepair component if:

- One or more key building components are old and, because of their condition, need replacing or major repair; or
- Two or more other building components are old and, because of their condition, need replacement or major repair.

Key building components are those which, if in poor condition, could have an immediate impact on the integrity of the building and cause further deterioration in other components. They are the external components plus internal components that have potential safety implications and include:

- External walls
- Roof structure and covering
- Windows/doors
- Chimneys
- Central heating boilers
- Electrics

If any of these components are old, and need replacing or require major repair, then the dwelling is not in a reasonable state of repair.

Other building components are those that have a less immediate impact on the integrity of the dwelling. Their combined effect is therefore considered, with a dwelling failing the disrepair standard if two or more elements are old and need replacing or require immediate major repair.

Map 8 shows the distribution of dwellings estimated to be in disrepair in Ealing and indicates that there are pockets of higher levels of disrepair across the area, particularly towards the south and east of Ealing. The data behind the map shows that the highest levels overall are in the wards of Walpole, Acton Central and Northfield. The highest levels of disrepair are seen scattered across Walpole ward, to the south of Acton Central ward and to the north and south east of Northfield ward. There are COAs with high concentrations of disrepair elsewhere, for example across much of Southfield, the north west and south east of Ealing Broadway, and the north of Elthorne and East Acton wards.

[48] https://www.gov.uk/government/publications/a-decent-home-definition-and-guidance

[49] There are 4 components to the Decent Homes Standard – HHSRS, disrepair, modernisation and thermal comfort

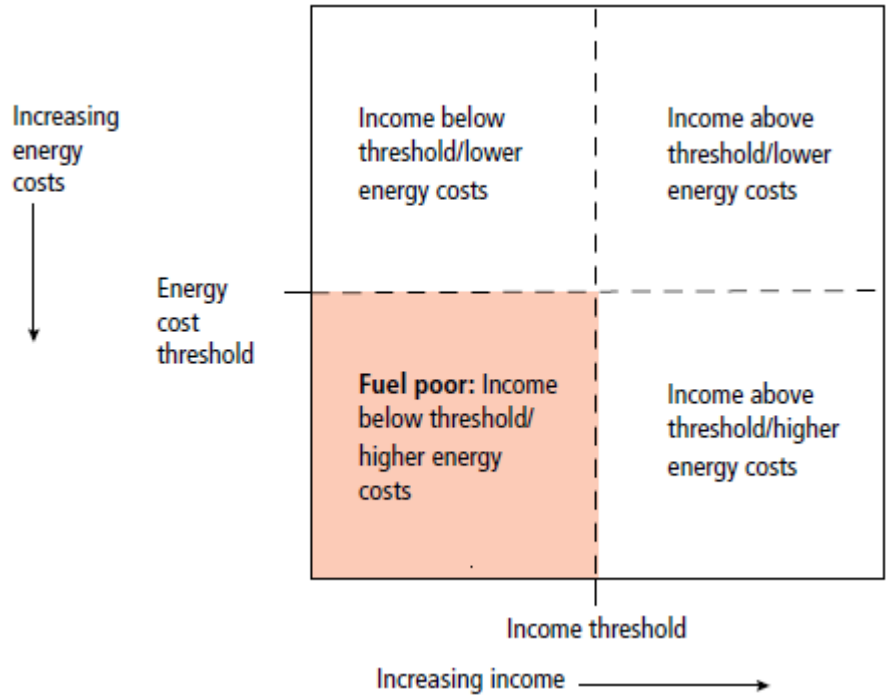
Map 8: Percentage of private sector dwellings in Ealing in disrepair

4.2.3.3 Fuel poverty

The current fuel poverty definition is known as the Low Income High Costs variable. This is a dual variable which firstly provides an indication of the number of households in fuel poverty and secondly an indication of the cost (in £) to remove households from fuel poverty – this cost is referred to as the Fuel Poverty Gap[50].

A household is said to be in fuel poverty if they have required fuel costs that are above average (the national median level) and were they to spend that amount they would be left with a residual income below the official poverty line (see the shaded area in **Figure 7** below). For the purposes of this report this is termed "fuel poverty (Low Income High Costs)".

Figure 7: A representation of the Low Income High Costs definition of fuel poverty[51]



As the Low Income High Cost fuel poverty variable is a relative measure, it provides a steady trend in the number of fuel poor households over time. A change in income will only have an impact on fuel poverty if households with low incomes and high costs see relatively larger income changes (increases or decreases) than the overall average change in income.

In contrast, the fuel poverty gap is more responsive to changes in energy prices and the economy, therefore providing a clearer measure of the depth of fuel poverty among those fuel poor households. This measure is therefore more useful for identifying trends in fuel poverty over time.

[50] DECC, Annual Fuel Poverty Statistics Report, 2016 – England (National Statistics), 20 June 2016

[51] Hills J, Getting the measure of fuel poverty – Final Report of the Fuel Poverty Review, London: LSE, 2012

Map 9 shows that, based on the Low Income High Costs definition, there are areas of higher concentrations towards the east and south of the borough, but with additional pockets of higher levels elsewhere. The wards with the highest concentrations overall are Acton Central, Walpole and South Acton. The highest concentration of fuel poverty in Acton Central is in the north east. In Walpole ward the highest concentrations are to the east and the north, and in South Acton ward higher concentrations are in the south.

The national indicators for the fuel poverty gap are expressed as the average fuel poverty gap, which is the average amount of money required to lift a fuel poor household out of fuel poverty (£321 in England in 2017), and the aggregated fuel poverty gap – i.e. the total amount of money required to lift *all* fuel poor households out of fuel poverty in England is £812 million (in 2017).

Figure 8 provides the national average fuel poverty gap figures by SAP band for private sector stock. By using the bandings based on the SimpleSAP model it is possible to estimate the aggregated fuel poverty gap within each band for the fuel poor households in Ealing. **Figure 9** shows similar estimates for the private rented sector. The estimated aggregated fuel poverty gap for fuel poor households in the private sector in Ealing is £5.72 million, of which £2.49 million is from the private rented sector.

The 1,106 private rented households living in dwellings with a SimpleSAP rating of F or G would require increases in income totalling £1,143,604 per year to lift them out of fuel poverty.

Figure 8: Aggregated fuel poverty gap figures for the private sector stock in Ealing by SAP band

	Avg fuel poverty gap (England 2017)	Ealing	
		Fuel poor households	Aggregated fuel poverty gap
	£	Count	£
(92-100) A (81-91) B (69-80) C	168	332	55,864
(55-68) D	223	3,145	702,614
(39-54) E	421	4,913	2,067,305
(21-38) F (1-20) G	1,056	2,739	2,893,061

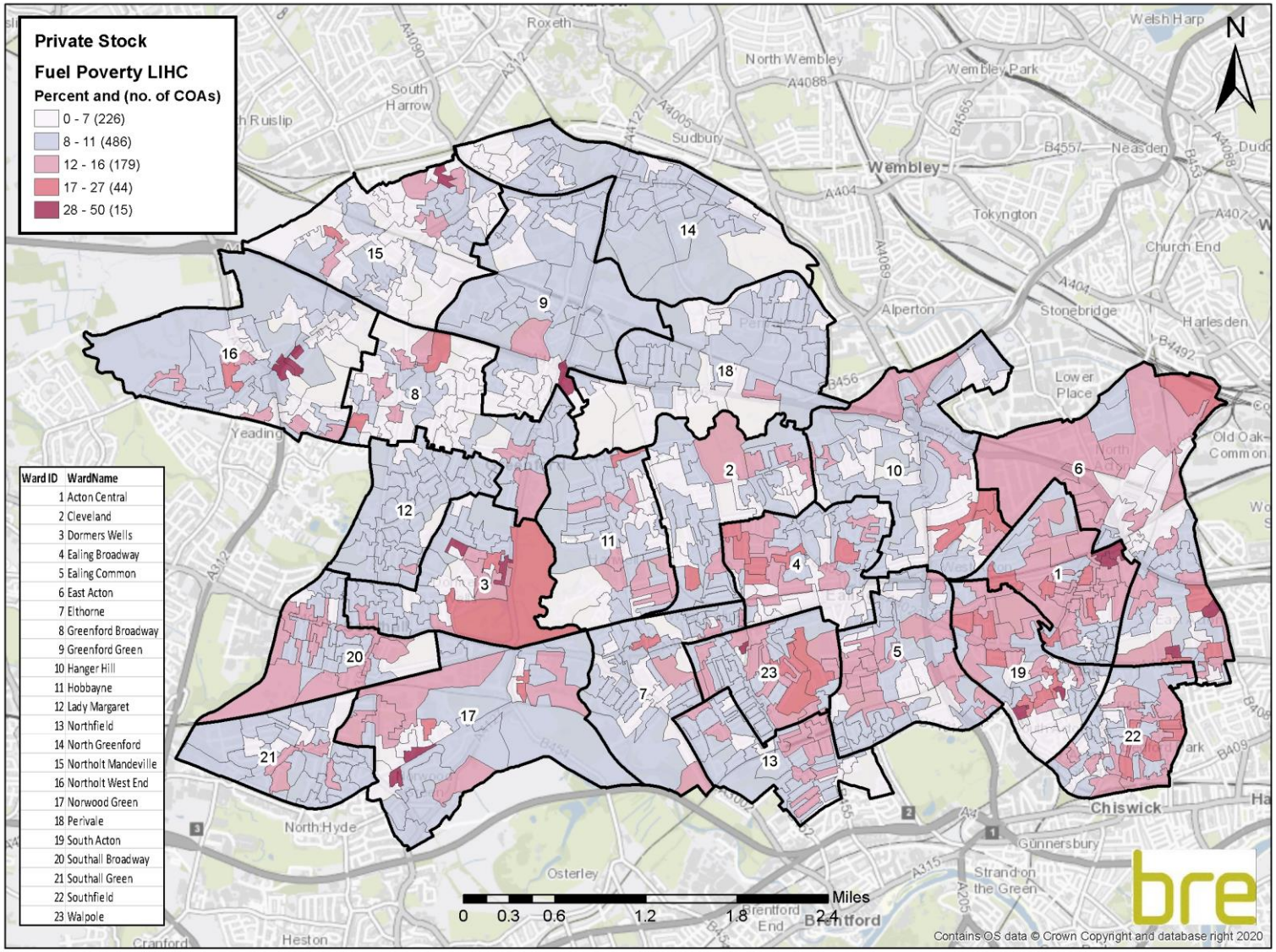
Figure 9: Aggregated fuel poverty gap figures for the private rented sector stock in Ealing by SAP band

	Avg fuel poverty gap (England 2017)	Ealing	
		Fuel poor households	Aggregated fuel poverty gap
	£	Count	£
(92-100) A (81-91) B (69-80) C	97	275	26,675
(55-68) D	203	2,186	443,758
(39-54) E	339	2,573	872,247
(21-38) F (1-20) G	1,034	1,106	1,143,604

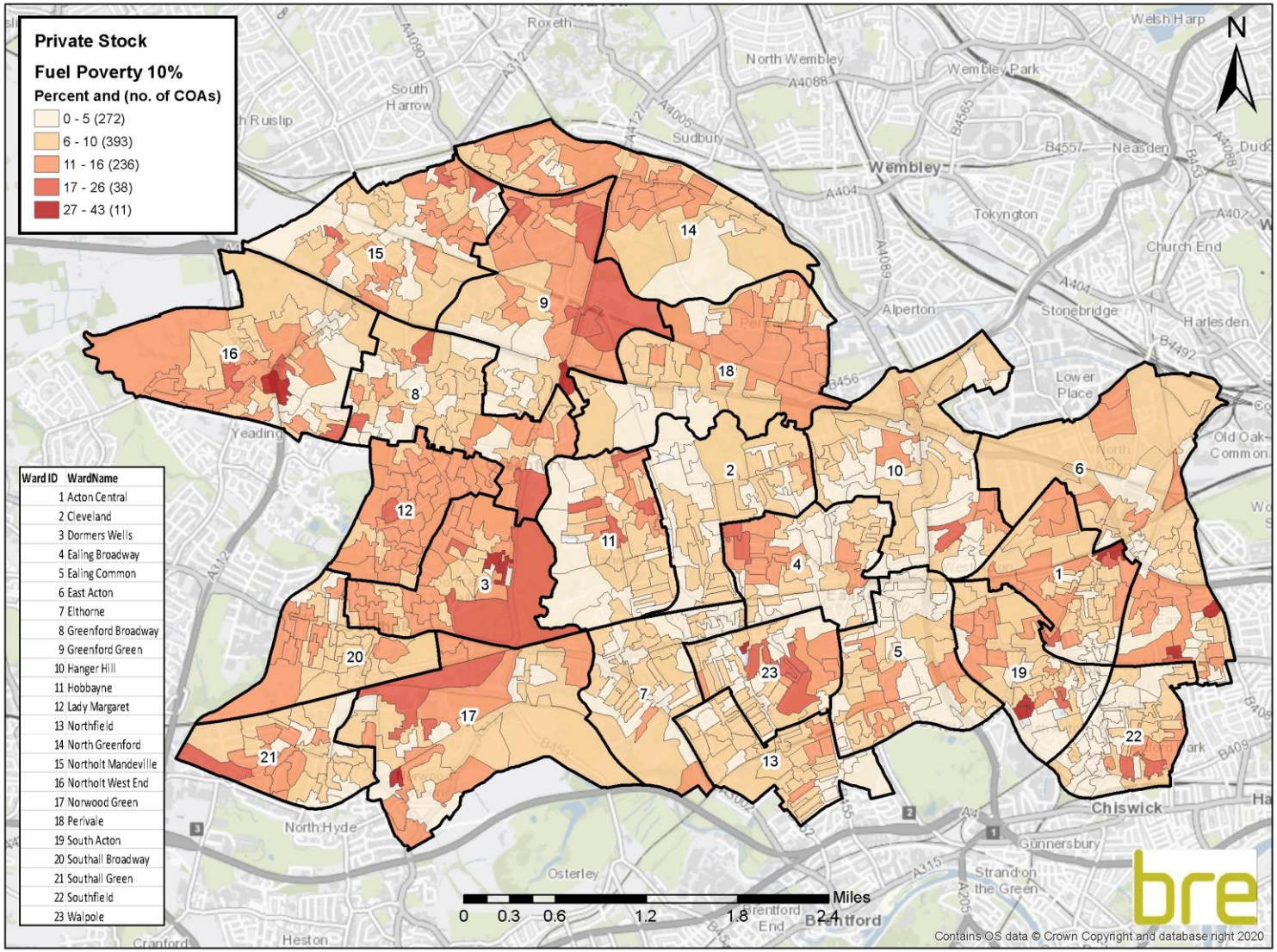
For completeness of information, and comparison with previous data, this report also includes an analysis of fuel poverty using the original definition. This states that a household is said to be in fuel poverty if it spends more than 10% of its income on fuel to maintain an adequate level of warmth (defined as 21°C for the main living area, and 18°C for other occupied rooms in the 2012 Hills Fuel Poverty Review[51]). For the purposes of this report this is referred to as “fuel poverty (10% definition)”.

Map 10 shows the distribution of households in fuel poverty using the 10% definition and suggests fuel poverty is more likely to the east and south of the borough with additional pockets of higher levels to the west under this definition.

Map 9: Percentage of private sector dwellings in Ealing occupied by households in fuel poverty - Low Income High Costs definition



Map 10: Percentage of private sector dwellings in Ealing occupied by households in fuel poverty – 10% definition



4.2.3.4 Low income households

A low income household is defined as a household in receipt of:

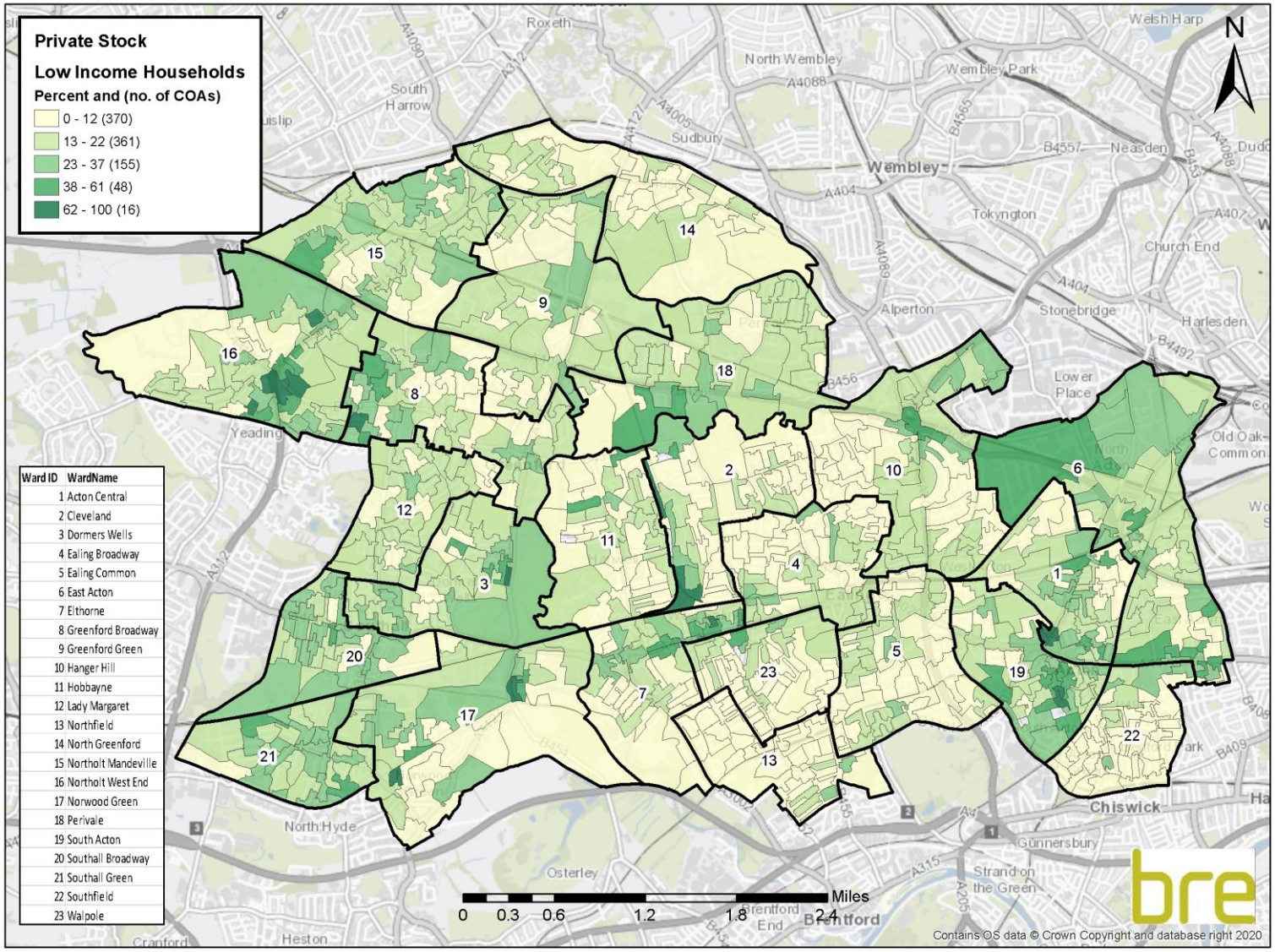
- Means tested benefits or tax credits with a relevant income below the threshold of £16,105
- Attendance allowance
- Disability living allowance
- Personal Independence Payment
- Industrial injuries disablement benefit
- War disablement pension
- Income support or income based Job Seekers Allowance/incapacity benefit that included an income support component
- income based Employment and Support Allowance
- Universal Credit
- Housing related benefits that help pay towards rent
- Any household on a low income that has had their income imputed up to their basic income support entitlement
- Pension credit
- Child tax credit
- Working tax credit

For child tax credit and working tax credit, the household is only considered a low income household if it has a relevant income of less than £16,105.

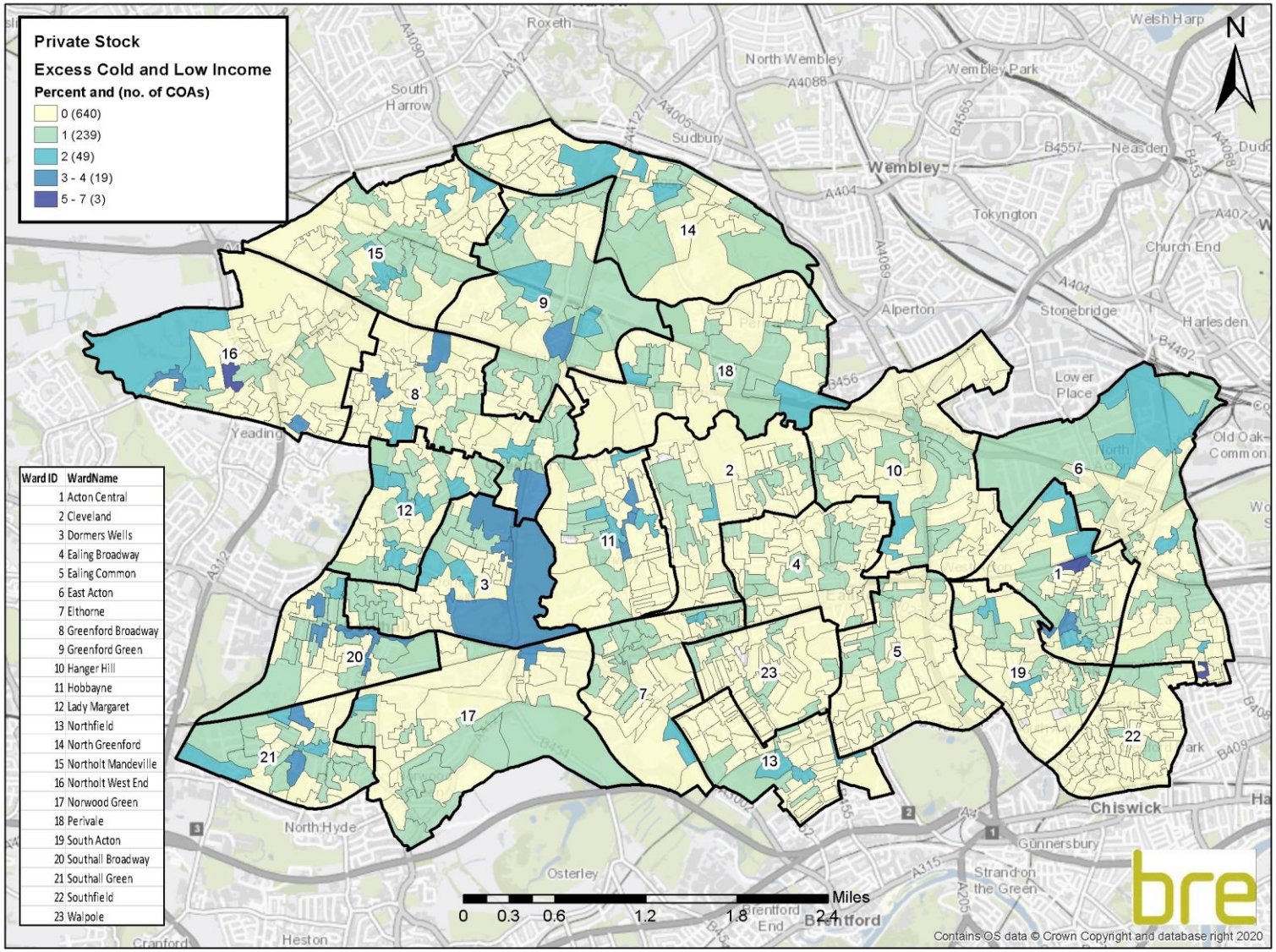
Map 11 shows that concentrations of low income households are greater to the west and east of Ealing, with pockets towards the centre of the borough. The data behind the map indicates that the highest levels overall are found in Southall Green, Southall Broadway and Acton Central wards. However, there are other areas which also have high concentrations of low income households including parts of Northolt West End ward, the southwest of Cleveland ward and central and southern parts of South Acton ward.

Map 12 provides an additional layer of information, with the data for low income households being combined with HHSRS excess cold data. This provides a vital picture of where vulnerable people are likely to be living in poor housing. The map indicates that there are pockets of both low income and excess cold mainly towards the west and east of the borough.

Map 11: Percentage of private sector dwellings in Ealing occupied by low income households



Map 12: Percentage of private sector dwellings in Ealing with both the presence of a HHSRS category 1 hazard for excess cold and occupied by low income households

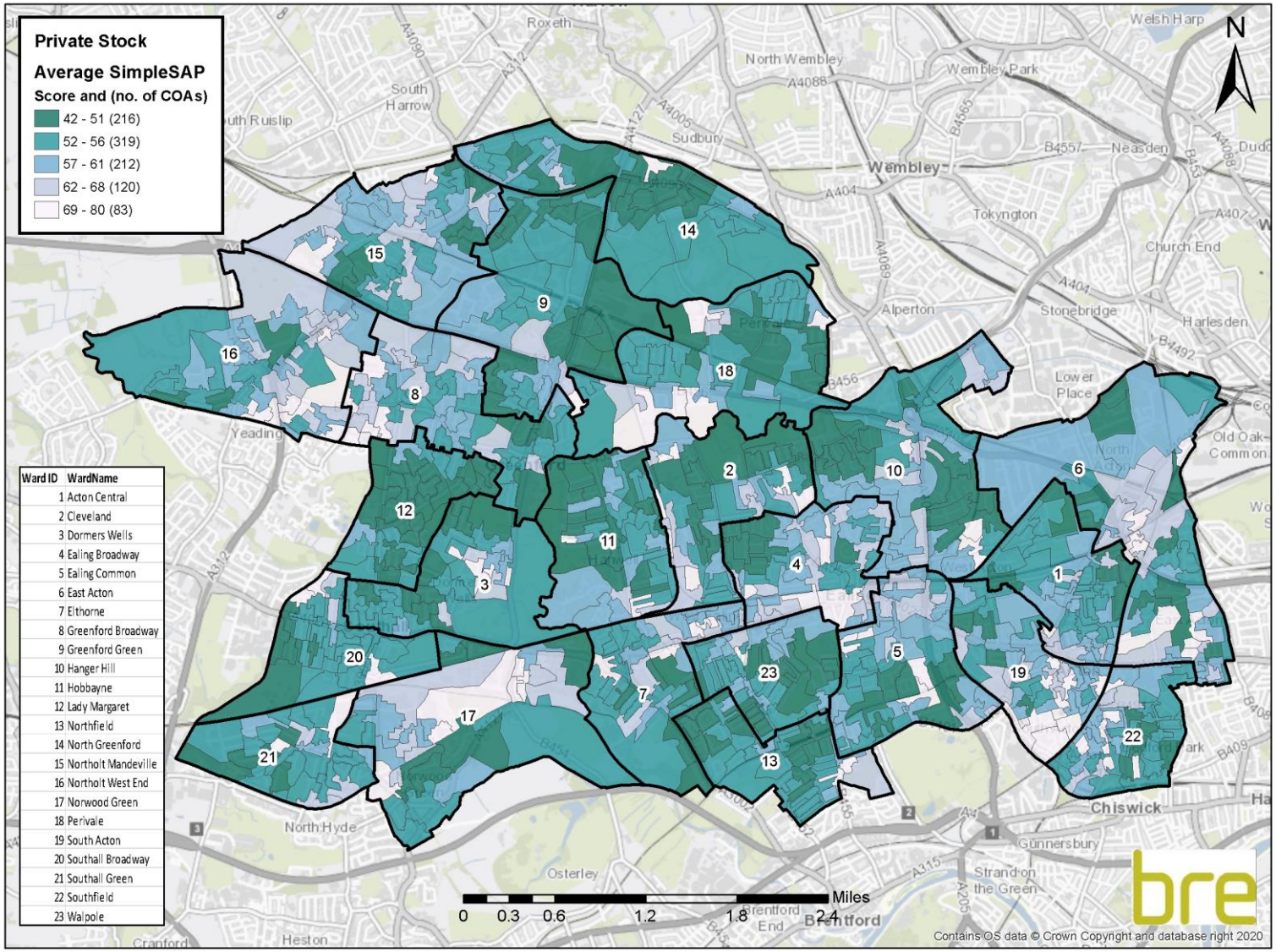


4.2.3.5 SimpleSAP

The average SimpleSAP map (**Map 13**) shows that areas with lower average SimpleSAP ratings are clustered throughout the borough. Whilst no particular ward obviously dominates, the data behind the map shows that the wards with the lowest average SimpleSAP ratings are Lady Margaret, Greenford Green and North Greenford.

Lower SimpleSAP ratings can occur in areas with larger, older homes where little work has been done by the occupiers to improve energy performance. The size of the home itself is not a factor in SimpleSAP, but these homes are more likely to be semi-detached or detached, and therefore have larger heat loss areas. Furthermore, the relatively low levels of new build houses and modern apartment blocks in this area impacts the prevalence of higher SimpleSAP ratings across the area, preventing the average rating being improved.

Map 13: Average SimpleSAP ratings per dwelling in Ealing private sector stock



4.2.4 Ward level results for the Housing Standards Variables

The previous maps have provided a visual representation of the Housing Standards Variables at Census Output Area (COA) level. The following tables provide the complete set of figures at ward level for each of the variables; firstly, for the total stock (**Table 5**) and secondly, for the private sector stock (**Table 6**), owner occupied sector stock (**Table 7**) and private rented sector stock (**Table 8**). This allows a direct comparison between the wards in Ealing.

Table 5: *Total stock* – number and percentage of dwellings for each of the Housing Standards Variables, and average SimpleSAP ratings by ward

Ward	Dwellings	HHSRS category 1 hazards			HHSRS category 2 hazards	Disrepair	Fuel poverty		Low income households	Average SimpleSAP
		All hazards	Excess cold	Fall hazards			10%	LIHC		
Acton Central	6,879	675 (10%)	276 (4%)	311 (5%)	3,255 (47%)	471 (7%)	670 (10%)	904 (13%)	2,000 (29%)	57
Cleveland	6,747	555 (8%)	278 (4%)	238 (4%)	2,979 (44%)	284 (4%)	610 (9%)	753 (11%)	1,962 (29%)	59
Dormers Wells	4,734	439 (9%)	191 (4%)	172 (4%)	2,217 (47%)	213 (4%)	615 (13%)	563 (12%)	1,918 (41%)	58
Ealing Broadway	7,656	775 (10%)	447 (6%)	270 (4%)	2,920 (38%)	463 (6%)	518 (7%)	727 (9%)	1,056 (14%)	61
Ealing Common	6,612	594 (9%)	299 (5%)	248 (4%)	2,716 (41%)	389 (6%)	467 (7%)	652 (10%)	967 (15%)	59
East Acton	10,175	953 (9%)	530 (5%)	301 (3%)	4,378 (43%)	458 (5%)	976 (10%)	1,157 (11%)	2,983 (29%)	62
Elthorne	6,683	647 (10%)	248 (4%)	324 (5%)	2,958 (44%)	414 (6%)	424 (6%)	628 (9%)	1,643 (25%)	59
Greenford Broadway	7,217	514 (7%)	181 (3%)	212 (3%)	3,190 (44%)	275 (4%)	612 (8%)	675 (9%)	2,456 (34%)	62
Greenford Green	5,395	600 (11%)	310 (6%)	239 (4%)	2,601 (48%)	274 (5%)	572 (11%)	472 (9%)	1,099 (20%)	54
Hanger Hill	6,946	658 (9%)	356 (5%)	261 (4%)	2,813 (40%)	358 (5%)	445 (6%)	581 (8%)	1,004 (14%)	57
Hobbayne	5,746	649 (11%)	309 (5%)	251 (4%)	2,903 (51%)	286 (5%)	542 (9%)	588 (10%)	1,303 (23%)	56
Lady Margaret	4,209	519 (12%)	257 (6%)	218 (5%)	2,002 (48%)	234 (6%)	493 (12%)	364 (9%)	676 (16%)	52
North Greenford	5,197	539 (10%)	227 (4%)	251 (5%)	2,463 (47%)	269 (5%)	504 (10%)	418 (8%)	804 (15%)	54
Northfield	5,602	633 (11%)	277 (5%)	325 (6%)	2,729 (49%)	375 (7%)	384 (7%)	549 (10%)	460 (8%)	54
Northolt Mandeville	6,260	471 (8%)	179 (3%)	206 (3%)	2,445 (39%)	240 (4%)	610 (10%)	598 (10%)	2,202 (35%)	60
Northolt West End	6,514	361 (6%)	121 (2%)	149 (2%)	2,604 (40%)	177 (3%)	656 (10%)	683 (10%)	2,853 (44%)	63
Norwood Green	5,323	396 (7%)	142 (3%)	169 (3%)	2,250 (42%)	198 (4%)	516 (10%)	584 (11%)	2,081 (39%)	62
Perivale	5,947	555 (9%)	230 (4%)	261 (4%)	2,411 (41%)	287 (5%)	545 (9%)	486 (8%)	1,175 (20%)	57

Table 5 cont.: *Total stock* – number and percentage of dwellings for each of the Housing Standards Variables, and average SimpleSAP ratings by ward

Ward	Dwellings	HHSRS category 1 hazards			HHSRS category 2 hazards	Disrepair	Fuel poverty		Low income households	Average SimpleSAP
		All hazards	Excess cold	Fall hazards			10%	LIHC		
South Acton	7,654	612 (8%)	270 (4%)	262 (3%)	3,318 (43%)	419 (5%)	664 (9%)	905 (12%)	2,713 (35%)	64
Southall Broadway	4,441	393 (9%)	142 (3%)	192 (4%)	2,055 (46%)	238 (5%)	414 (9%)	470 (11%)	1,254 (28%)	57
Southall Green	5,299	515 (10%)	204 (4%)	227 (4%)	2,389 (45%)	301 (6%)	443 (8%)	502 (9%)	1,511 (29%)	58
Southfield	7,375	638 (9%)	225 (3%)	357 (5%)	2,958 (40%)	480 (7%)	442 (6%)	760 (10%)	790 (11%)	60
Walpole	5,769	722 (13%)	325 (6%)	346 (6%)	3,030 (53%)	454 (8%)	480 (8%)	666 (12%)	784 (14%)	54

N.B. the information on hazards refers to the number of dwellings with a hazard of the stated type. Because of this there is likely to be some overlap – for example, some dwellings are likely to have excess cold and fall hazards but this dwelling would only be represented once under 'all hazards'. The number of dwellings under 'all hazards' can therefore be less than the sum of the excess cold plus fall hazards.

Table 6: *Private sector stock* – number and percentage of dwellings for each of the Housing Standards Variables, and average SimpleSAP ratings by ward

Ward	Dwellings	HHSRS category 1 hazards			HHSRS category 2 hazards	Disrepair	Fuel poverty		Low income households	Average SimpleSAP
		All hazards	Excess cold	Fall hazards			10%	LIHC		
Acton Central	6,005	627 (10%)	263 (4%)	298 (5%)	2,911 (48%)	444 (7%)	497 (8%)	737 (12%)	1,300 (22%)	56
Cleveland	5,219	507 (10%)	269 (5%)	222 (4%)	2,098 (40%)	258 (5%)	318 (6%)	458 (9%)	605 (12%)	57
Dormers Wells	2,977	345 (12%)	161 (5%)	146 (5%)	1,335 (45%)	167 (6%)	343 (12%)	284 (10%)	566 (19%)	54
Ealing Broadway	7,345	758 (10%)	445 (6%)	265 (4%)	2,778 (38%)	452 (6%)	503 (7%)	697 (9%)	964 (13%)	60
Ealing Common	6,119	562 (9%)	290 (5%)	239 (4%)	2,471 (40%)	370 (6%)	385 (6%)	580 (9%)	686 (11%)	59
East Acton	7,938	574 (7%)	236 (3%)	260 (3%)	3,020 (38%)	382 (5%)	532 (7%)	762 (10%)	1,659 (21%)	62
Elthorne	5,998	609 (10%)	239 (4%)	312 (5%)	2,581 (43%)	392 (7%)	342 (6%)	544 (9%)	1,188 (20%)	58
Greenford Broadway	4,410	343 (8%)	132 (3%)	166 (4%)	1,610 (37%)	196 (4%)	335 (8%)	332 (8%)	816 (19%)	60
Greenford Green	4,582	562 (12%)	303 (7%)	229 (5%)	2,151 (47%)	252 (5%)	502 (11%)	398 (9%)	623 (14%)	52
Hanger Hill	6,769	647 (10%)	354 (5%)	258 (4%)	2,750 (41%)	352 (5%)	439 (6%)	562 (8%)	934 (14%)	57
Hobbayne	4,470	545 (12%)	284 (6%)	222 (5%)	1,982 (44%)	236 (5%)	352 (8%)	410 (9%)	620 (14%)	55
Lady Margaret	4,067	506 (12%)	255 (6%)	215 (5%)	1,935 (48%)	227 (6%)	479 (12%)	348 (9%)	629 (15%)	51
North Greenford	4,759	510 (11%)	219 (5%)	244 (5%)	2,240 (47%)	257 (5%)	476 (10%)	385 (8%)	613 (13%)	53
Northfield	5,494	621 (11%)	273 (5%)	322 (6%)	2,681 (49%)	370 (7%)	376 (7%)	537 (10%)	436 (8%)	54
Northolt Mandeville	3,999	342 (9%)	140 (4%)	169 (4%)	1,480 (37%)	175 (4%)	335 (8%)	301 (8%)	741 (19%)	57
Northolt West End	3,173	190 (6%)	69 (2%)	101 (3%)	990 (31%)	97 (3%)	235 (7%)	229 (7%)	617 (19%)	62
Norwood Green	2,953	299 (10%)	127 (4%)	135 (5%)	1,295 (44%)	157 (5%)	252 (9%)	263 (9%)	425 (14%)	57
Perivale	5,495	533 (10%)	224 (4%)	254 (5%)	2,217 (40%)	275 (5%)	513 (9%)	437 (8%)	945 (17%)	56

Table 6 cont.: *Private sector stock* – number and percentage of dwellings for each of the Housing Standards Variables, and average SimpleSAP ratings by ward

Ward	Dwellings	HHSRS category 1 hazards			HHSRS category 2 hazards	Disrepair	Fuel poverty		Low income households	Average SimpleSAP
		All hazards	Excess cold	Fall hazards			10%	LIHC		
South Acton	5,959	544 (9%)	264 (4%)	238 (4%)	2,408 (40%)	378 (6%)	426 (7%)	658 (11%)	1,288 (22%)	62
Southall Broadway	3,818	356 (9%)	132 (3%)	183 (5%)	1,734 (45%)	221 (6%)	351 (9%)	404 (11%)	902 (24%)	56
Southall Green	4,644	480 (10%)	193 (4%)	220 (5%)	2,172 (47%)	287 (6%)	404 (9%)	448 (10%)	1,154 (25%)	57
Southfield	7,041	621 (9%)	222 (3%)	352 (5%)	2,821 (40%)	469 (7%)	423 (6%)	731 (10%)	666 (9%)	59
Walpole	5,472	701 (13%)	318 (6%)	341 (6%)	2,859 (52%)	445 (8%)	437 (8%)	625 (11%)	551 (10%)	54

N.B. the information on hazards refers to the number of dwellings with a hazard of the stated type. Because of this there is likely to be some overlap – for example, some dwellings are likely to have excess cold and fall hazards but this dwelling would only be represented once under 'all hazards'. The number of dwellings under 'all hazards' can therefore be less than the sum of the excess cold plus fall hazards.

Table 7: *Owner occupied sector stock* – number and percentage of dwellings for each of the Housing Standards Variables, and average SimpleSAP ratings by ward

Ward	Dwellings	HHSRS category 1 hazards			HHSRS category 2 hazards	Disrepair	Fuel poverty		Low income households	Average SimpleSAP
		All hazards	Excess cold	Fall hazards			10%	LIHC		
Acton Central	2,273	294 (13%)	162 (7%)	133 (6%)	1,058 (47%)	143 (6%)	261 (11%)	208 (9%)	300 (13%)	52
Cleveland	3,619	387 (11%)	220 (6%)	168 (5%)	1,460 (40%)	167 (5%)	240 (7%)	258 (7%)	243 (7%)	55
Dormers Wells	2,166	264 (12%)	133 (6%)	112 (5%)	945 (44%)	113 (5%)	274 (13%)	156 (7%)	294 (14%)	52
Ealing Broadway	3,234	458 (14%)	333 (10%)	131 (4%)	1,202 (37%)	164 (5%)	324 (10%)	253 (8%)	308 (10%)	57
Ealing Common	3,310	349 (11%)	214 (6%)	139 (4%)	1,255 (38%)	165 (5%)	253 (8%)	212 (6%)	255 (8%)	57
East Acton	2,907	257 (9%)	127 (4%)	113 (4%)	1,064 (37%)	114 (4%)	270 (9%)	184 (6%)	374 (13%)	59
Elthorne	3,233	392 (12%)	173 (5%)	204 (6%)	1,394 (43%)	203 (6%)	216 (7%)	230 (7%)	356 (11%)	55
Greenford Broadway	3,012	245 (8%)	100 (3%)	122 (4%)	1,086 (36%)	121 (4%)	255 (8%)	168 (6%)	344 (11%)	58
Greenford Green	3,503	452 (13%)	255 (7%)	182 (5%)	1,624 (46%)	178 (5%)	411 (12%)	234 (7%)	376 (11%)	51
Hanger Hill	4,050	451 (11%)	273 (7%)	170 (4%)	1,571 (39%)	187 (5%)	308 (8%)	250 (6%)	337 (8%)	55
Hobbayne	3,233	430 (13%)	239 (7%)	172 (5%)	1,432 (44%)	161 (5%)	259 (8%)	232 (7%)	288 (9%)	53
Lady Margaret	3,343	424 (13%)	222 (7%)	179 (5%)	1,531 (46%)	176 (5%)	400 (12%)	232 (7%)	421 (13%)	51
North Greenford	3,697	409 (11%)	186 (5%)	195 (5%)	1,673 (45%)	186 (5%)	386 (10%)	242 (7%)	362 (10%)	52
Northfield	3,733	458 (12%)	216 (6%)	242 (6%)	1,748 (47%)	239 (6%)	291 (8%)	305 (8%)	195 (5%)	52
Northolt Mandeville	2,989	270 (9%)	123 (4%)	130 (4%)	1,106 (37%)	122 (4%)	274 (9%)	170 (6%)	416 (14%)	56
Northolt West End	2,299	149 (6%)	58 (3%)	79 (3%)	769 (33%)	69 (3%)	182 (8%)	125 (5%)	319 (14%)	60
Norwood Green	2,084	225 (11%)	105 (5%)	101 (5%)	916 (44%)	101 (5%)	187 (9%)	143 (7%)	217 (10%)	55
Perivale	4,209	418 (10%)	183 (4%)	203 (5%)	1,647 (39%)	200 (5%)	418 (10%)	262 (6%)	636 (15%)	55

Table 7 cont.: *Owner occupied sector stock* – number and percentage of dwellings for each of the Housing Standards Variables, and average SimpleSAP ratings by ward

Ward	Dwellings	HHSRS category 1 hazards			HHSRS category 2 hazards	Disrepair	Fuel poverty		Low income households	Average SimpleSAP
		All hazards	Excess cold	Fall hazards			10%	LIHC		
South Acton	2,005	269 (13%)	163 (8%)	104 (5%)	868 (43%)	118 (6%)	218 (11%)	176 (9%)	260 (13%)	56
Southall Broadway	2,171	209 (10%)	87 (4%)	106 (5%)	806 (37%)	103 (5%)	208 (10%)	144 (7%)	304 (14%)	55
Southall Green	2,268	271 (12%)	129 (6%)	119 (5%)	953 (42%)	122 (5%)	236 (10%)	148 (7%)	340 (15%)	54
Southfield	4,076	402 (10%)	170 (4%)	231 (6%)	1,613 (40%)	250 (6%)	296 (7%)	347 (9%)	254 (6%)	57
Walpole	3,267	485 (15%)	253 (8%)	225 (7%)	1,654 (51%)	237 (7%)	328 (10%)	310 (9%)	214 (7%)	51

N.B. the information on hazards refers to the number of dwellings with a hazard of the stated type. Because of this there is likely to be some overlap – for example, some dwellings are likely to have excess cold and fall hazards but this dwelling would only be represented once under 'all hazards'. The number of dwellings under 'all hazards' can therefore be less than the sum of the excess cold plus fall hazards.

Table 8: *Private rented sector stock* – number and percentage of dwellings for each of the Housing Standards Variables, and average SimpleSAP ratings by ward

Ward	Dwellings	HHSRS category 1 hazards			HHSRS category 2 hazards	Disrepair	Fuel poverty		Low income households	Average SimpleSAP
		All hazards	Excess cold	Fall hazards			10%	LIHC		
Acton Central	3,732	333 (9%)	101 (3%)	165 (4%)	1,853 (50%)	301 (8%)	236 (6%)	529 (14%)	1,000 (27%)	59
Cleveland	1,600	120 (8%)	49 (3%)	54 (3%)	638 (40%)	91 (6%)	78 (5%)	200 (13%)	362 (23%)	61
Dormers Wells	811	81 (10%)	28 (3%)	34 (4%)	390 (48%)	54 (7%)	69 (9%)	128 (16%)	272 (34%)	58
Ealing Broadway	4,111	300 (7%)	112 (3%)	134 (3%)	1,576 (38%)	288 (7%)	179 (4%)	444 (11%)	656 (16%)	64
Ealing Common	2,809	213 (8%)	76 (3%)	100 (4%)	1,216 (43%)	205 (7%)	132 (5%)	368 (13%)	431 (15%)	61
East Acton	5,031	317 (6%)	109 (2%)	147 (3%)	1,956 (39%)	268 (5%)	262 (5%)	578 (11%)	1,285 (26%)	64
Elthorne	2,765	217 (8%)	66 (2%)	108 (4%)	1,187 (43%)	189 (7%)	126 (5%)	314 (11%)	832 (30%)	62
Greenford Broadway	1,398	98 (7%)	32 (2%)	44 (3%)	524 (37%)	75 (5%)	80 (6%)	164 (12%)	472 (34%)	63
Greenford Green	1,079	110 (10%)	48 (4%)	47 (4%)	527 (49%)	74 (7%)	91 (8%)	164 (15%)	247 (23%)	55
Hanger Hill	2,719	196 (7%)	81 (3%)	88 (3%)	1,179 (43%)	165 (6%)	131 (5%)	312 (11%)	597 (22%)	60
Hobbayne	1,237	115 (9%)	45 (4%)	50 (4%)	550 (44%)	75 (6%)	93 (8%)	178 (14%)	332 (27%)	59
Lady Margaret	724	82 (11%)	33 (5%)	36 (5%)	404 (56%)	51 (7%)	79 (11%)	116 (16%)	208 (29%)	53
North Greenford	1,062	101 (10%)	33 (3%)	49 (5%)	567 (53%)	71 (7%)	90 (8%)	143 (13%)	251 (24%)	57
Northfield	1,761	163 (9%)	57 (3%)	80 (5%)	933 (53%)	131 (7%)	85 (5%)	232 (13%)	241 (14%)	58
Northolt Mandeville	1,010	72 (7%)	17 (2%)	39 (4%)	374 (37%)	53 (5%)	61 (6%)	131 (13%)	325 (32%)	61
Northolt West End	874	41 (5%)	11 (1%)	22 (3%)	221 (25%)	28 (3%)	53 (6%)	104 (12%)	298 (34%)	65
Norwood Green	869	74 (9%)	22 (3%)	34 (4%)	379 (44%)	56 (6%)	65 (7%)	120 (14%)	208 (24%)	62
Perivale	1,286	115 (9%)	41 (3%)	51 (4%)	570 (44%)	75 (6%)	95 (7%)	175 (14%)	309 (24%)	59

Table 8 cont.: *Private rented sector stock* – number and percentage of dwellings for each of the Housing Standards Variables, and average SimpleSAP ratings by ward

Ward	Dwellings	HHSRS category 1 hazards			HHSRS category 2 hazards	Disrepair	Fuel poverty		Low income households	Average SimpleSAP
		All hazards	Excess cold	Fall hazards			10%	LIHC		
South Acton	3,954	275 (7%)	101 (3%)	134 (3%)	1,540 (39%)	260 (7%)	208 (5%)	482 (12%)	1,028 (26%)	64
Southall Broadway	1,647	147 (9%)	45 (3%)	77 (5%)	928 (56%)	118 (7%)	143 (9%)	260 (16%)	598 (36%)	56
Southall Green	2,376	209 (9%)	64 (3%)	101 (4%)	1,219 (51%)	165 (7%)	168 (7%)	300 (13%)	814 (34%)	60
Southfield	2,965	219 (7%)	52 (2%)	121 (4%)	1,208 (41%)	219 (7%)	127 (4%)	384 (13%)	412 (14%)	63
Walpole	2,205	216 (10%)	65 (3%)	116 (5%)	1,205 (55%)	208 (9%)	109 (5%)	315 (14%)	337 (15%)	58

N.B. the information on hazards refers to the number of dwellings with a hazard of the stated type. Because of this there is likely to be some overlap – for example, some dwellings are likely to have excess cold and fall hazards but this dwelling would only be represented once under 'all hazards'. The number of dwellings under 'all hazards' can therefore be less than the sum of the excess cold plus fall hazards.

4.3 Information relating to LAHS reporting and EPC ratings

4.3.1 Cost of mitigating category 1 hazards in the Ealing private sector stock

Table 9 shows the total number of dwellings with HHSRS category 1 hazards in Ealing's private sector stock and the total cost for mitigating all hazards within those dwellings. The costs are based on the average cost of mitigating category 1 hazards for the region using EHS 2015 data. The EHS costs are determined following a surveyor's assessment of the hazard. For each hazard the surveyor is given a range of common treatments that they can specify in order to treat the hazard. Where quantities are required the surveyor may specify them. The treatment recommended by the surveyor is then costed using a standard set of prices.

Table 9: Estimated costs to mitigate all category 1 hazards in private sector stock, split into tenure

Tenure	No. of hazards	Total cost (£)
Private Sector	11,782	45,414,924
Owner occupied	7,968	30,713,471
Private rented	3,814	14,701,453

4.3.2 Houses in Multiple Occupation (HMOs) in the Ealing private sector stock

The Housing Act 2004 introduced a new set of definitions for HMOs in England from 6 April 2006[52]. The definition is a complex one and the bullet points below, which are adapted from web pages provided by the National HMO Network[53], provide a summary:

- An entire house or flat which is let to 3 or more tenants who form 2 or more households and who share a kitchen, bathroom or toilet
- A house which has been converted entirely into bedsits or other non-self-contained accommodation and which is let to 3 or more tenants who form two or more households and who share kitchen, bathroom or toilet facilities
- A converted house which contains one or more flats which are not wholly self-contained (i.e. the flat does not contain within it a kitchen, bathroom and toilet) and which is occupied by 3 or more tenants who form two or more households
- A building which is converted entirely into self-contained flats if the conversion did not meet the standards of the 1991 Building Regulations and more than one-third of the flats are let on short-term tenancies

The recently published "Houses in Multiple Occupation and residential property licensing reform"[54] provides guidance to local authorities on changes to rules on licensing HMOs. From 1 October 2018, mandatory

[52] See Sections 254-258 of the Housing Act (http://www.legislation.gov.uk/ukpga/2004/34/contents)

[53] National HMO Network http://www.nationalhmonetwork.com/definition.php

licensing of HMOs was extended to cover all relevant HMOs regardless of the number of storeys (compared to the previous definition which limited this to buildings of 3 or more storeys). Purpose built flats will only require a licence where there are fewer than 3 flats in the block. The requirement for the HMO to be occupied by five or more persons in two or more households will remain[55]. From 1 October 2018, the extension came into effect and those dwellings that fall under the new definition will require a licence.

To be classified as an HMO the property must be used as the tenants' only or main residence and it should be used solely or mainly to house tenants. Properties let to students and migrant workers will be treated as their only or main residence and the same will apply to properties which are used as domestic refuges.

The LAHS requires estimates of the number of HMOs and the number of mandatory licensable HMOs.

- Number of private sector HMOs
    - Modelled using specific criteria from a number of Experian data sources and information derived from the SimpleCO_2 model. The criteria include privately rented dwellings with 3 or more bedrooms occupied by male/female/mixed home sharers, mixed occupancy dwellings or classified as the following Experian Mosaic classifications:
        - Renting a room
        - Career Builders
        - Flexible Workforce
        - Bus Route Renters
        - Learners and earners
        - Student scene
- Number of mandatory licensable HMOs under the Government's new definition, as of 1 October 2018
    - This has been modelled using the above criteria for HMOs plus the dwelling must have 4 or more bedrooms. This will apply to both houses and converted flats.
    - Purpose built flats where there are up to two flats in the block and one or both have 4 or more bedrooms.

Table 10 summarises the results for the private sector stock in Ealing, while **Map 14** shows the geographic distribution of HMOs and **Map 15** shows the distribution of mandatory licensable HMOs. The maps show the majority of HMOs to be concentrated towards southern and eastern parts of Ealing, particularly around mainline and tube stations as well as along main roads such as parts of the A40. There are notable concentrations to the south of East Acton ward, the north of Hanger Hill ward and the west of Norwood Green ward. Licensable HMOs are mainly found in the east of Ealing. As previously mentioned, ward level data on HMOs is available in the accompanying Housing Stock Condition Database (HSCD) and **Appendix C** provides guidance on how to use the database.

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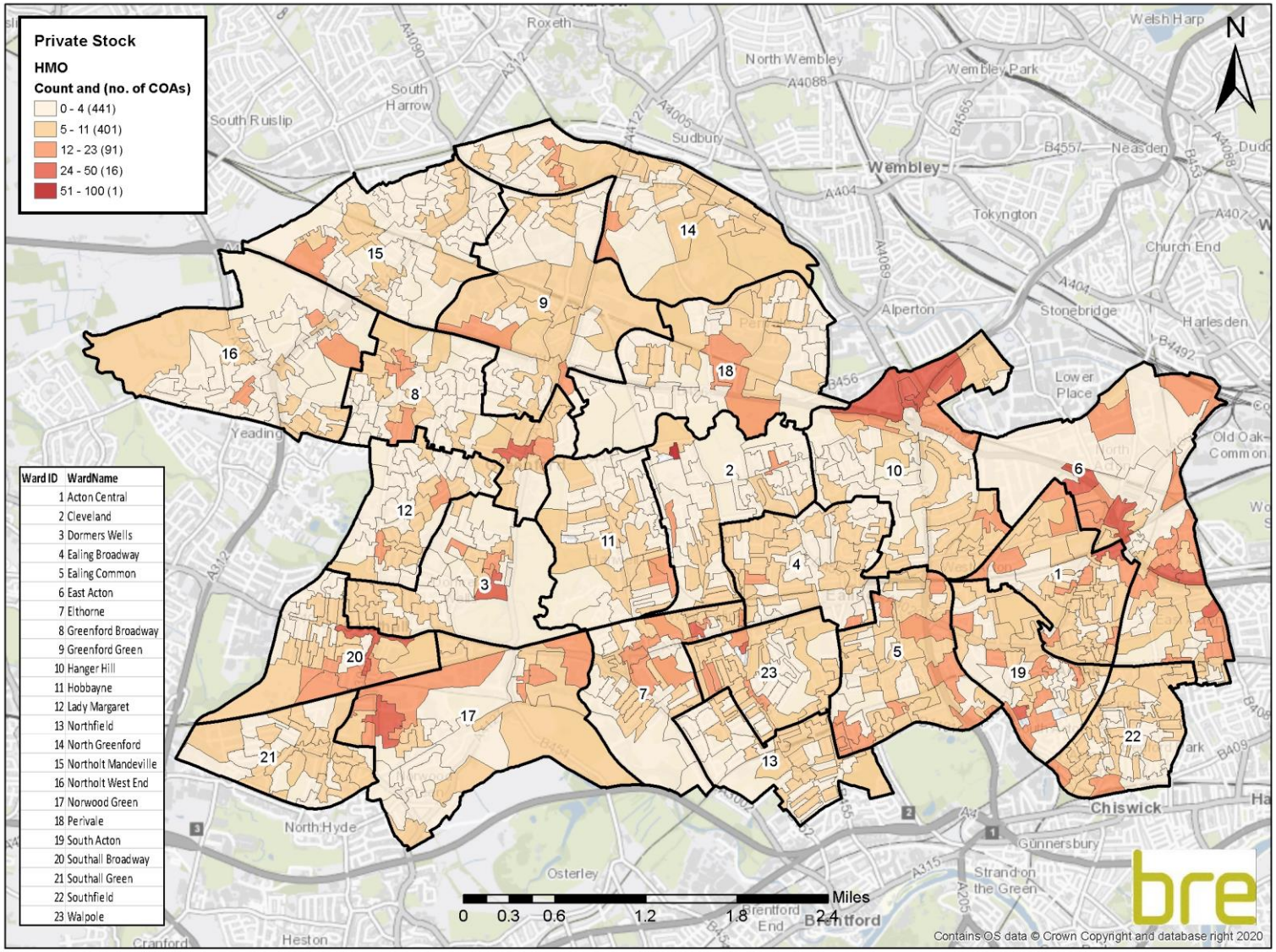
54 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/670536/HMO_licensing_reforms_response.pdf

55 In addition, new mandatory licence conditions will be introduced relating to national minimum sleeping room sizes and provision of waste disposal.

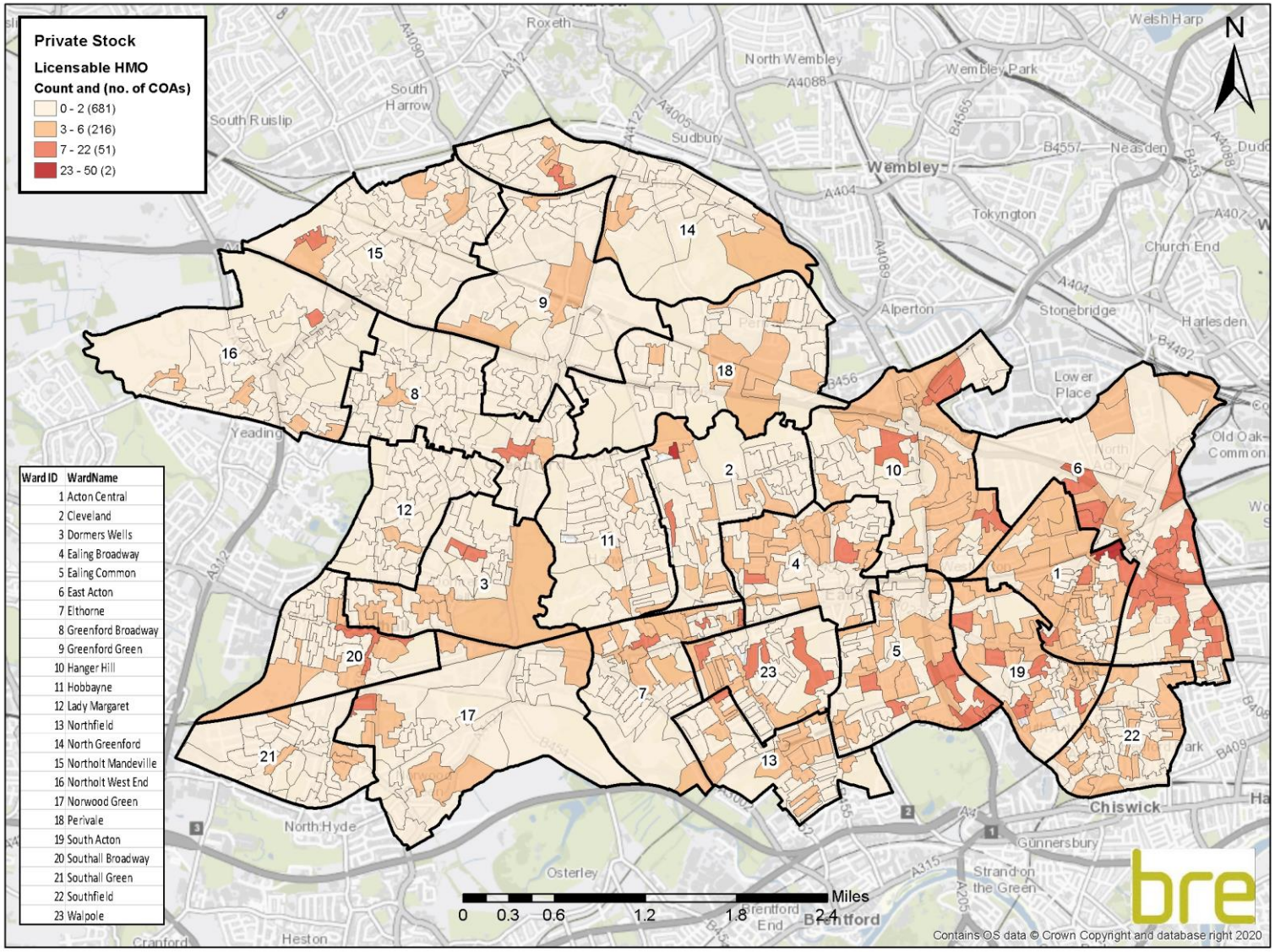
Table 10: Summary of estimated potential HMOs within the Ealing private sector stock

Ealing	No. of private sector dwellings	HMOs	Mandatory Licensing Scheme HMOs
	118,706	6,957	2,308

Map 14: Count of HMOs



Map 15: Count of mandatory licensable HMOs



4.3.3 EPC ratings in the Ealing private sector stock

An Energy Performance Certificate (EPC) is required whenever a new building is constructed, or an existing building is sold or rented out. An EPC is a measure of the energy efficiency performance of a building and is rated from band A – G, with A representing the best performance. The EPC ratings correspond to a range of SAP ratings from 1 – 100, with 100 being the best. It is possible, therefore, to give a dwelling an EPC rating based on the SAP rating.

Figure 10 below shows the bands A – G and corresponding SAP ratings in brackets. The first two columns show the number and percentage of Ealing's private sector stock falling into each of the EPC ratings bands based on SimpleSAP. The third column shows the comparable figures for the private sector stock in England.

The estimated average SimpleSAP for the private sector stock in Ealing is 57 which corresponds to an EPC rating of D. The number of private sector dwellings with an EPC rating below band E is estimated to be 10,151 (8.6%). Ealing has a higher proportion of dwellings in band E to G and lower proportions in bands C and D.

Figure 10: Number and percentage of Ealing's *private sector stock* falling into each of the EPC ratings bands (based on SimpleSAP), compared to England (EHS) figures *N.B. England figures report band A and B together*

	Ealing		2015 EHS England
	Count	Percent	Percent
(92-100) A	0	0.0%	1.1%
(81-91) B	2,843	2.4%	
(69-80) C	22,376	18.8%	23.2%
(55-68) D	46,158	38.9%	51.9%
(39-54) E	37,178	31.3%	18.5%
(21-38) F	8,751	7.4%	4.3%
(1-20) G	1,400	1.2%	1.1%

Under the Energy Act 2011, from 1 April 2018 landlords have to ensure that when they grant a tenancy to a new or existing tenant, their properties must meet a minimum energy efficiency standard – this is currently set at band E[15, 56]. From 1 April 2020, landlords can no longer continue letting a property which is already let if it has an EPC rating of F or G[57].

Figure 11 shows the breakdown of SimpleSAP results into the A – G bands for the private rented stock only and compared to the figures for this tenure in England as a whole. The number of private rented dwellings in Ealing with a rating below band E (i.e. bands F and G), is estimated to be 2,530 (5.3%). Compared to England, there are a greater proportion of dwellings in band C, E and F and lower proportions in bands D and G.

The distribution of dwellings with EPC ratings below band E is shown in **Map 16**. These are for the private rented stock only, since this is affected by the new rules on minimum standards. Under the legislation these properties are not be eligible to be rented out under new or renewed tenancies, and existing tenancies from 1 April 2020.

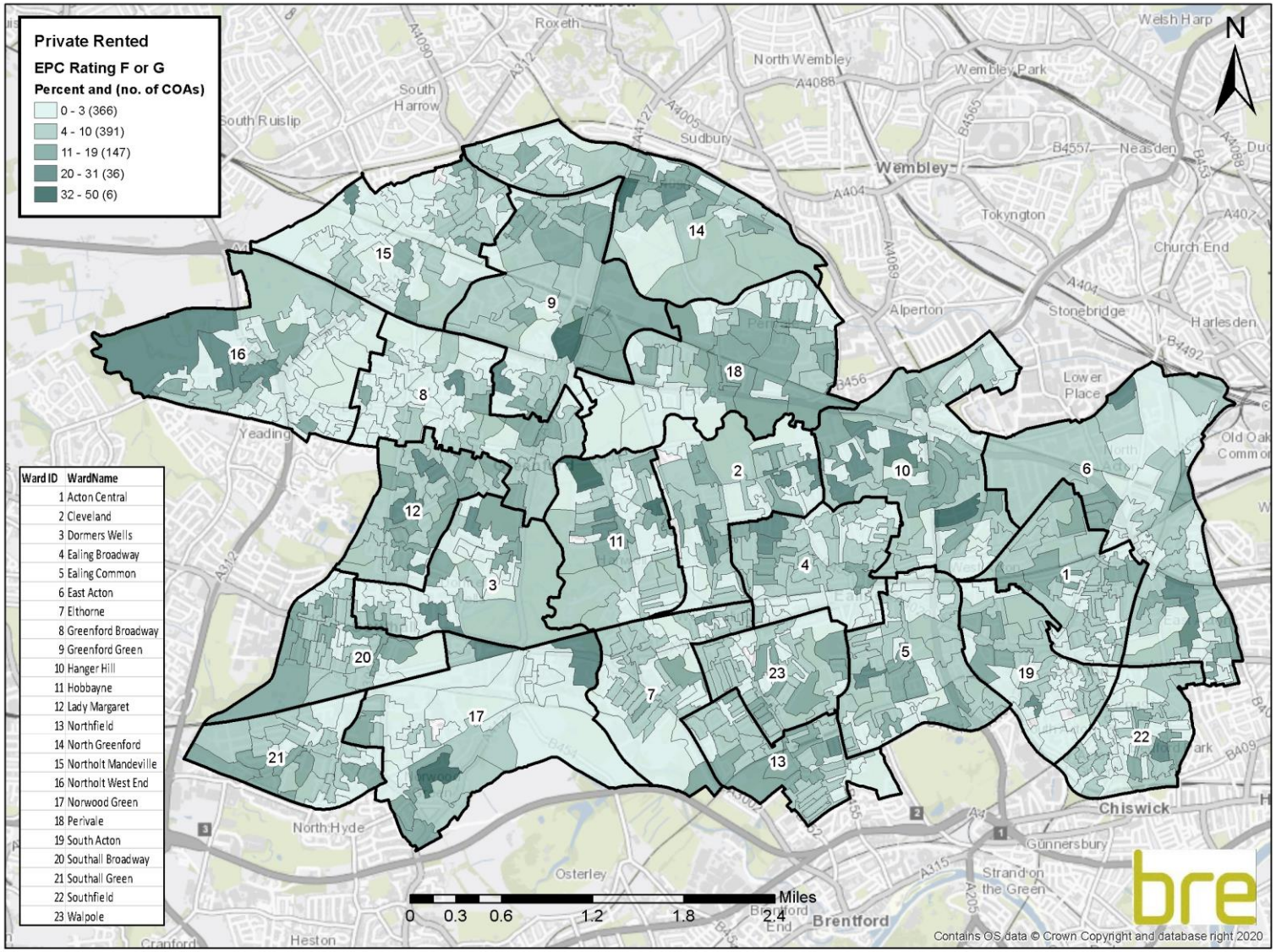
Figure 11: Number and percentage of Ealing's *private rented stock* falling into each of the EPC ratings bands (based on SimpleSAP), compared to England (EHS) figures *N.B. England figures report band A and B together*

	Ealing		2015 EHS England
	Count	Percent	Percent
(92-100) A	0	0.0%	1.2%
(81-91) B	1,664	3.5%	
(69-80) C	12,584	26.2%	25.3%
(55-68) D	19,846	41.3%	49.1%
(39-54) E	11,401	23.7%	18.1%
(21-38) F	2,241	4.7%	4.5%
(1-20) G	289	0.6%	1.8%

[56] Although landlords will still be able to rent out F and G rated properties after this date they will not be able to renew or sign a new contract.

[57] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794253/domestic-prs-minimum-standard-guidance.pdf

Map 16: Distribution of dwellings with F or G EPC ratings in the private rented stock



4.4 Energy efficiency variables for Ealing

Section 2.5 provides an overview of the ECO policy – two of the main energy efficiency improvements that fall under these policies are insulation of cavity walls and lofts. An understanding of the numbers and geographical distribution of dwellings which would be suitable for such improvements is a useful step in targeting resources in Ealing. The BRE Models have been used to determine the following variables for Ealing:

- Wall type and presence of cavity wall insulation
  - Solid wall
  - Insulated cavity wall
  - Un-insulated cavity wall

- Presence and level of loft insulation
  - No loft
  - Loft with no insulation
  - Level of loft insulation – 50, 100, 150, 200, 250+ mm loft insulation

Table 11 and **Table 12** show the modelled results in terms of the numbers and percentages of dwellings in Ealing's private sector stock for walls and lofts respectively (ward level data can be obtained from the housing stock condition database supplied alongside this report). They also show the percentage figures for the London region and for England overall to enable comparison. The results indicate that a proportion of the private sector stock in Ealing could benefit from energy efficiency improvements with an estimated 18,335 dwellings (15%) having un-insulated cavity walls. It is estimated that 37% of the housing stock in Ealing has cavity walls; whilst this is much lower than the national figure, there are still opportunities for improvements in dwellings without cavity wall insulation - this amounts to an estimated 42% of cavity walls which are uninsulated. The proportion of solid walls in Ealing is much higher than for England as a whole (62% compared with 31%), but similar to the London region (66%). Furthermore, there are an estimated 21,429 dwellings (18% of Ealing's private sector stock) which have less than 100mm of loft insulation with 13,351 (11%) having no loft insulation at all.

These types of dwellings are likely to be of particular interest to ECO providers or other energy efficiency improvement programmes, such as the Green Homes Grant scheme and the distribution of these dwellings is shown in **Map 17** to **Map 19**.

Map 17 shows that the prevalence of un-insulated cavities is greater across central and northern parts of the Ealing area. **Map 18** shows that there are pockets of areas with solid walls distributed throughout the area. **Map 19** shows that areas with lower levels of loft insulation (100mm or less) are also scattered throughout the area.

Table 11: Estimates of the numbers and percentage of dwellings for each of the energy efficiency variables for walls assessed for the private sector stock in Ealing and compared to the London region and national figure (EHS 2015)

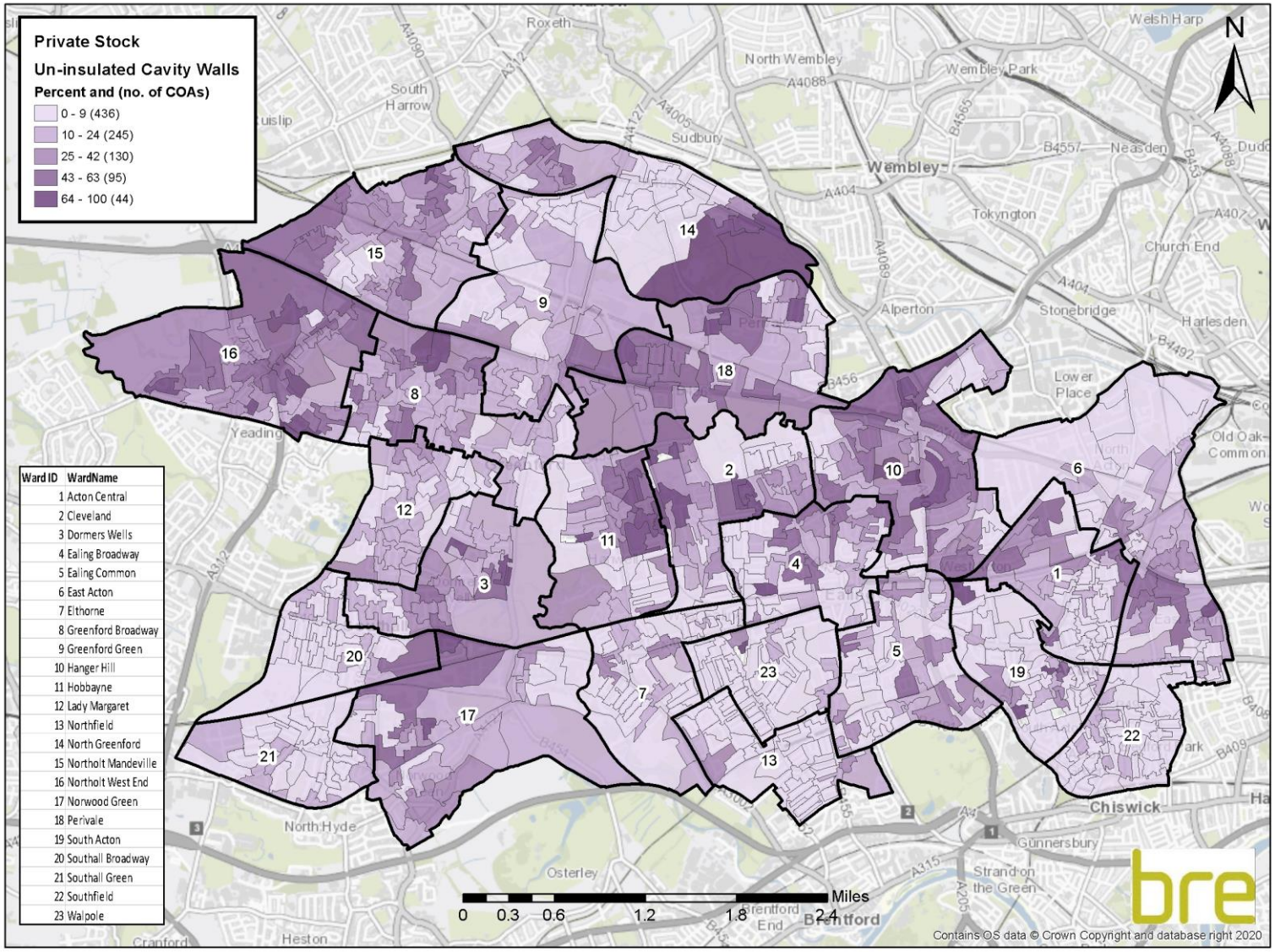
Variable		Private stock		2015 EHS Regional (private stock)	2015 EHS England (private stock)
		No.	%	%	%
No. of private sector dwellings		118,706	-	-	-
Wall type	Solid	73,093	62%	66%	31%
	Insulated cavity	25,548	22%	18%	45%
	Un-insulated cavity	18,335	15%	15%	22%
% of cavity walls only that are uninsulated		-	42%	46%	32%

N.B. the different wall types do not add up to the total number of private sector dwellings due to the small number of timber-frame and stone buildings

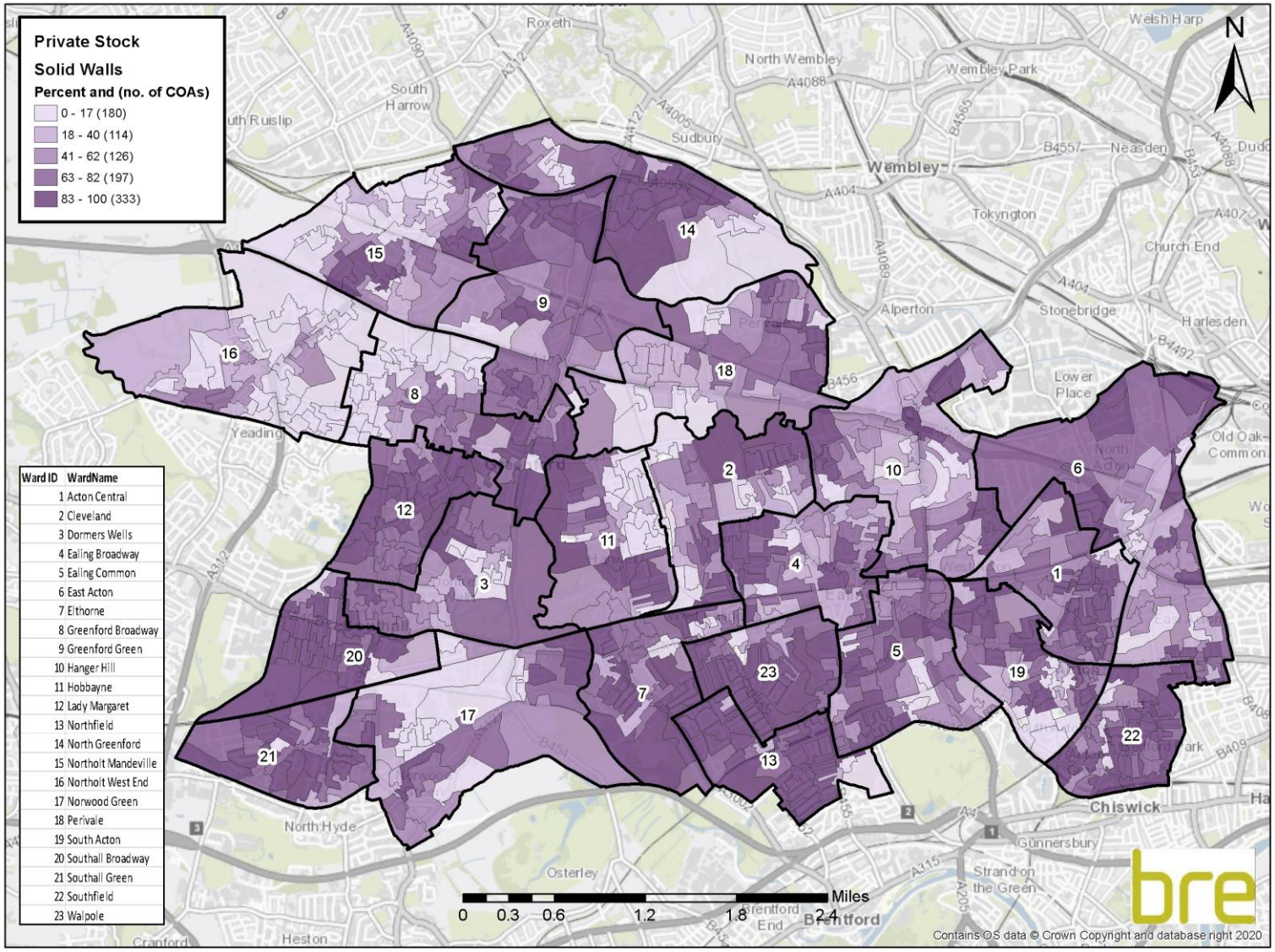
Table 12: Estimates of the numbers and percentage of dwellings for each of the energy efficiency variables for lofts assessed for the private sector stock in Ealing and compared to the London region and national figure (EHS 2015)

Variable		Private stock		2015 EHS Regional (private stock)	2015 EHS England (private stock)
		No.	%	%	%
No. of private sector dwellings		118,706	-	-	-
Level of loft insulation	No loft	41,962	35%	26%	9%
	No insulation	13,351	11%	5%	3%
	50mm	8,078	7%	6%	6%
	100mm	20,350	17%	26%	25%
	150mm	10,987	9%	16%	19%
	200mm	10,154	9%	11%	14%
	250+mm	13,824	12%	9%	24%
Less than 100mm		21,429	18%	11%	9%

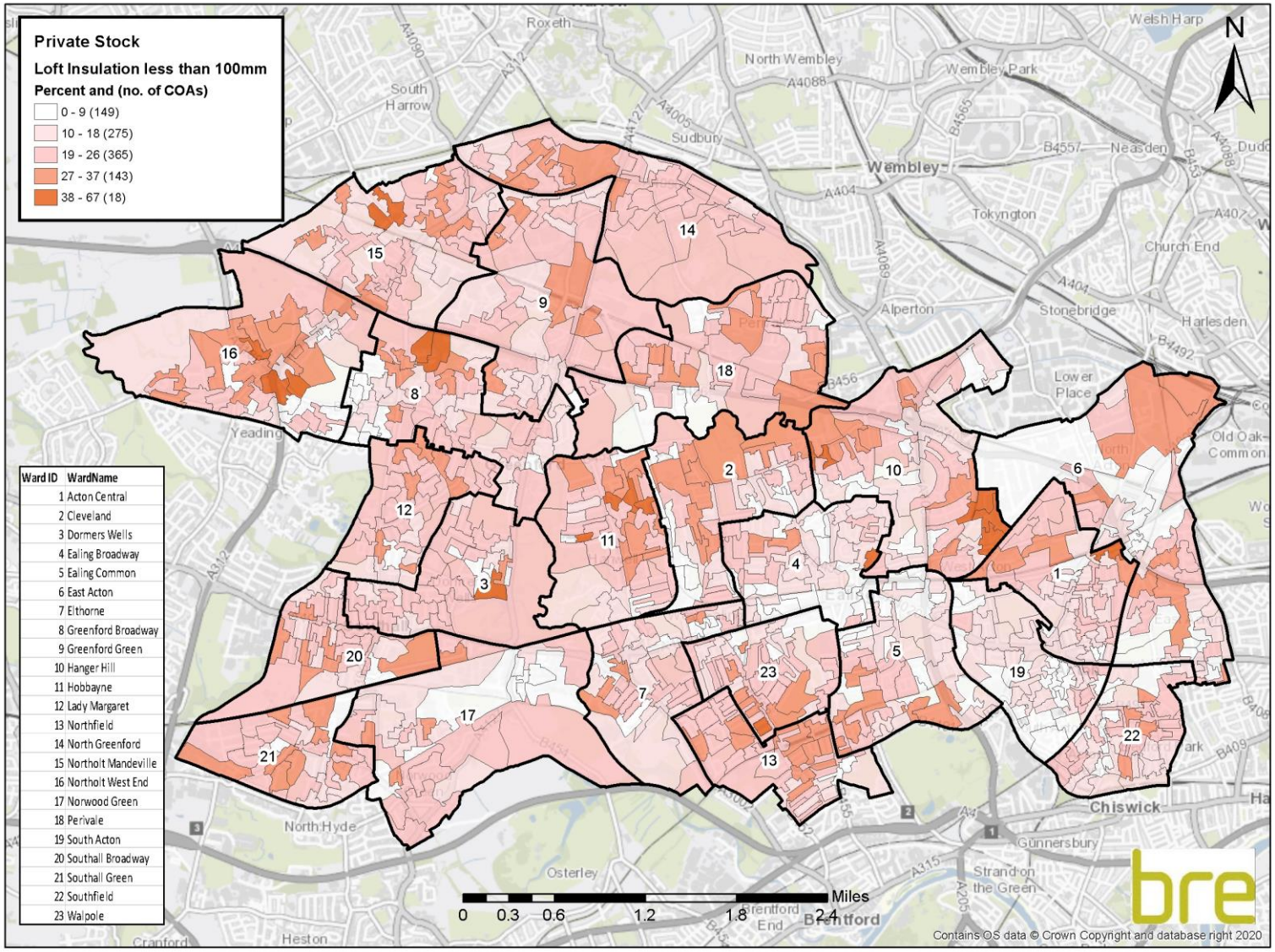
Map 17: Energy efficiency variables - percentage of private sector dwellings in Ealing with un-insulated cavity walls



Map 18: Energy efficiency variables - percentage of private sector dwellings in Ealing with solid walls



Map 19: Energy efficiency variables – percentage of private sector dwellings in Ealing with less than 100mm or no loft insulation



4.5 Energy planning variables for Ealing

In addition to the energy efficiency Housing Standards Variables, the "energy outputs" part of the housing stock modelling approach (see **Figure 1**) provides the database with estimates of a number of other energy efficiency variables. These variables are: SimpleSAP, notional SimpleCO_2, notional energy demand and cost, notional heat demand and cost. **Table 13** shows the energy efficiency variables in terms of the average figure per dwelling in Ealing, split by tenure. It is clear that the owner occupied stock has the highest average figures for the majority of the variables which may, in part, be due to owner occupied dwellings being larger than those in the other tenures. Such information provides a useful picture of the local housing stock and can also be useful in planning infrastructure projects such as district heating schemes, or for projects seeking to lever in ECO funding.

Table 13: Modelled data for average energy efficiency variables per dwelling by tenure in Ealing

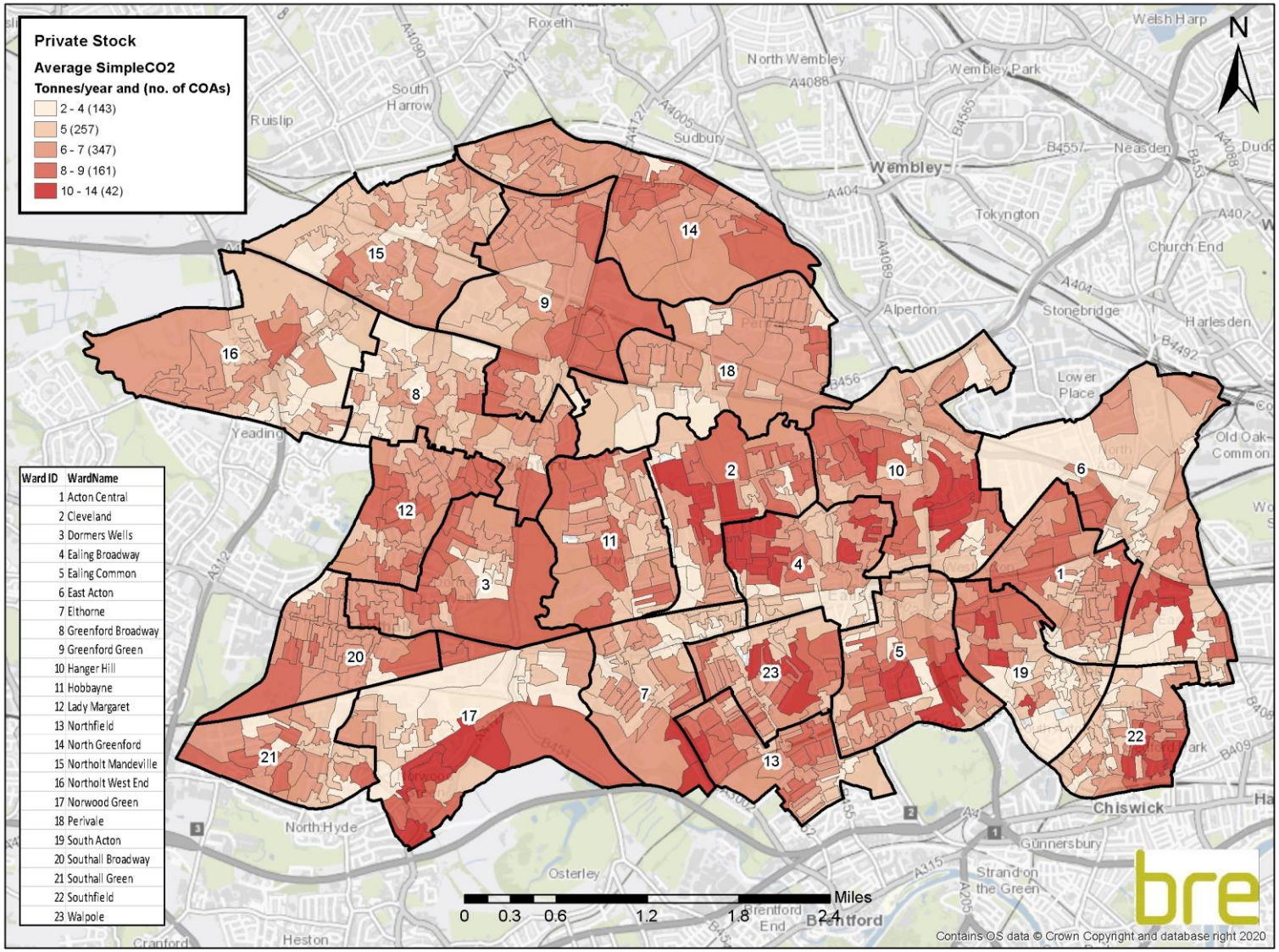
Variable	Tenure		
	Owner occupied	Private rented	Social
No. of dwellings	70,681	48,025	25,674
SimpleSAP	55	61	64
SimpleCO_2 (t/yr)	6.37	4.14	3.61
Energy demand (kWh/yr)	27,008	16,985	14,052
Energy cost (£/yr)	1,198	820	725
Electricity demand (KWh)	1,596	1,409	1,683
Electricity cost (£)	181	160	173
Heat demand (kWh/yr)	16,542	10,041	7,819
Heat cost (£/yr)	826	498	394

Map 20 shows the average SimpleCO_2 per year for Ealing and **Map 21** and **Map 22** show the average total energy demand and the average total energy cost per year.

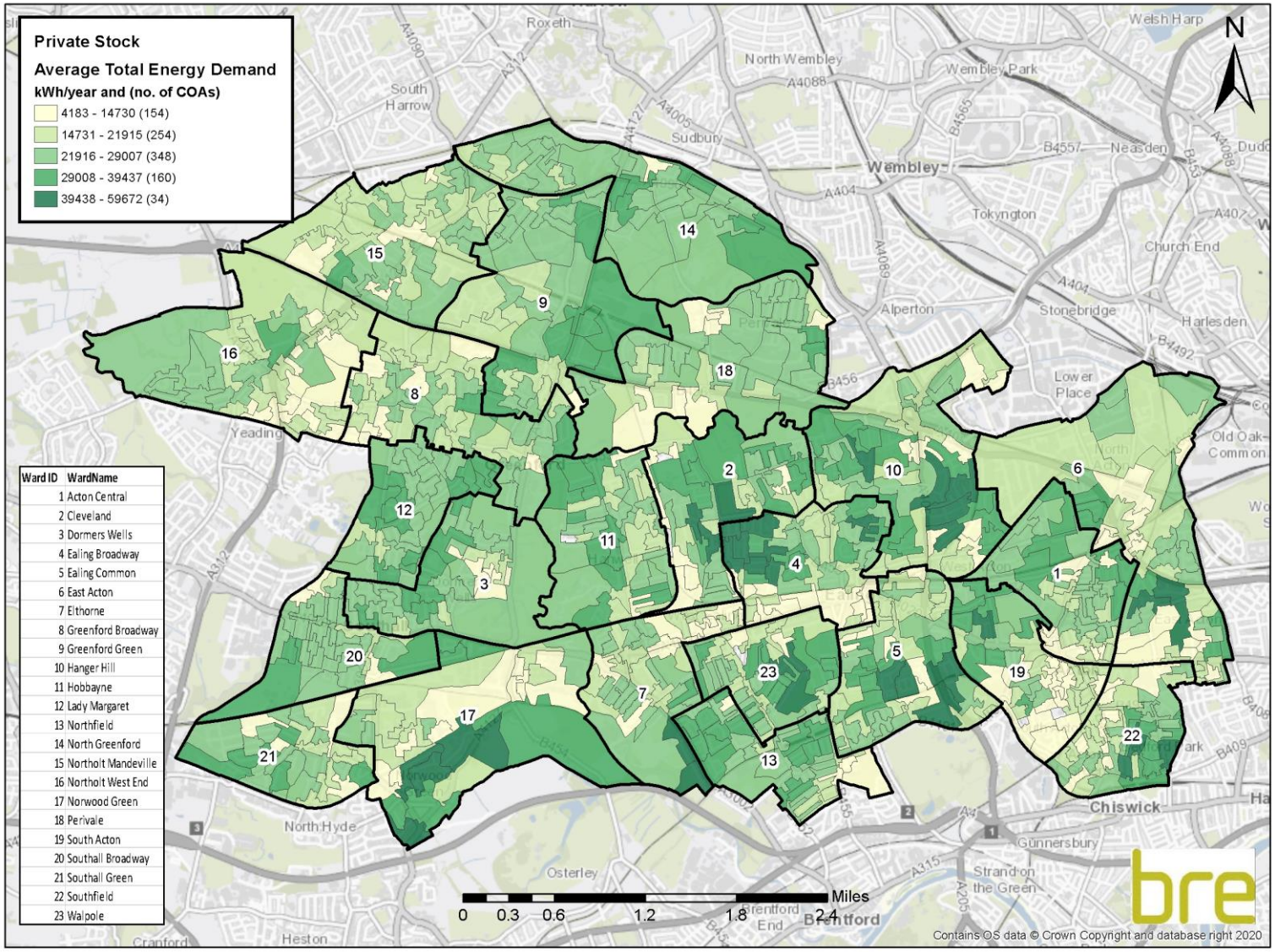
These maps show similar patterns since higher energy demand is generally likely to result in higher energy costs and carbon emissions. In general energy demand and cost seems to be higher in towards the south and east of the borough. This can be the case in areas with larger detached houses.

Map 23 and **Map 24** show the average total heat demand and the average total heating cost per year for Ealing. These show a similar pattern to the energy demand and energy cost maps.

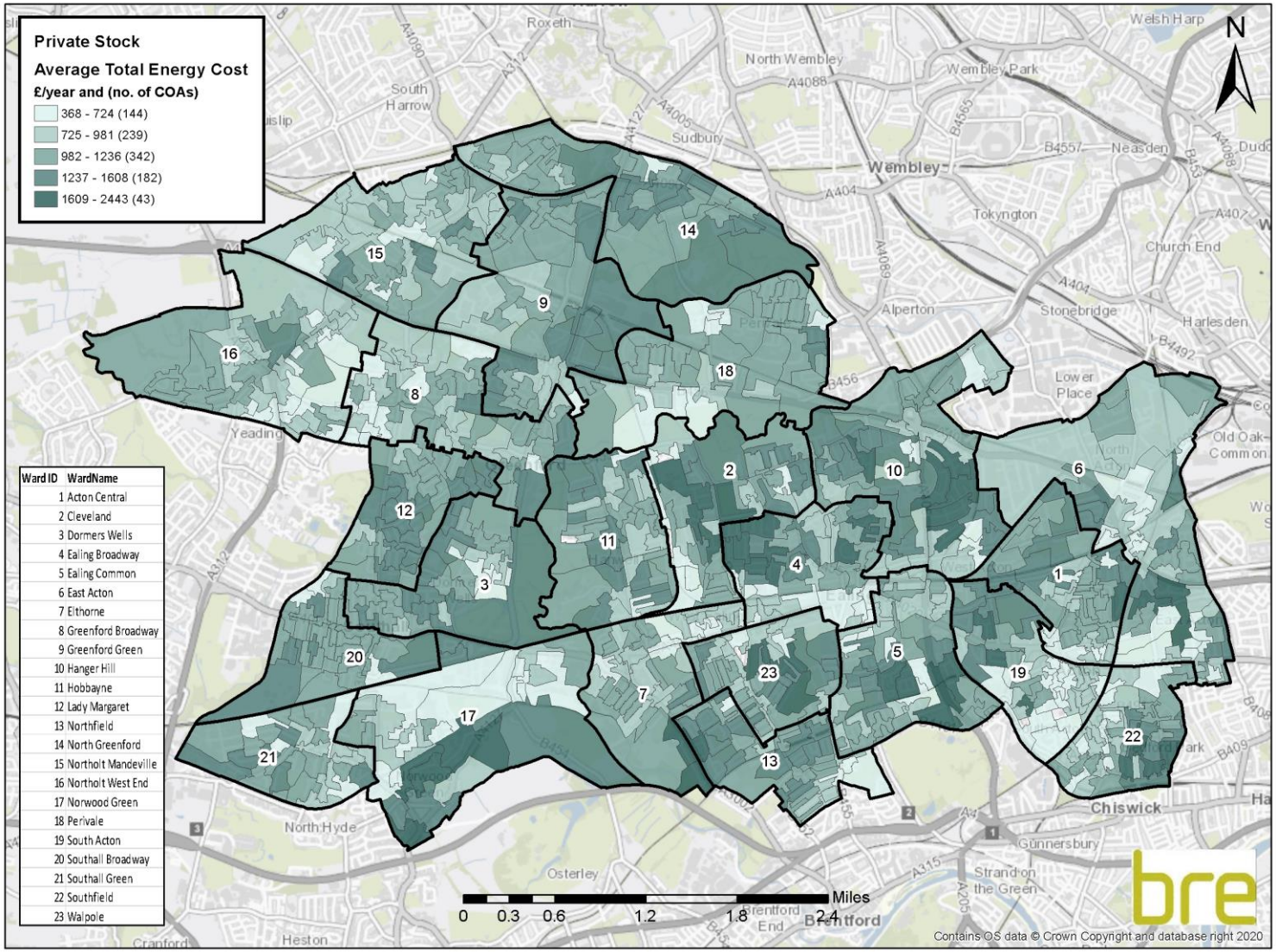
Map 20: Average Simple CO_2 (tonnes/year) – private sector stock



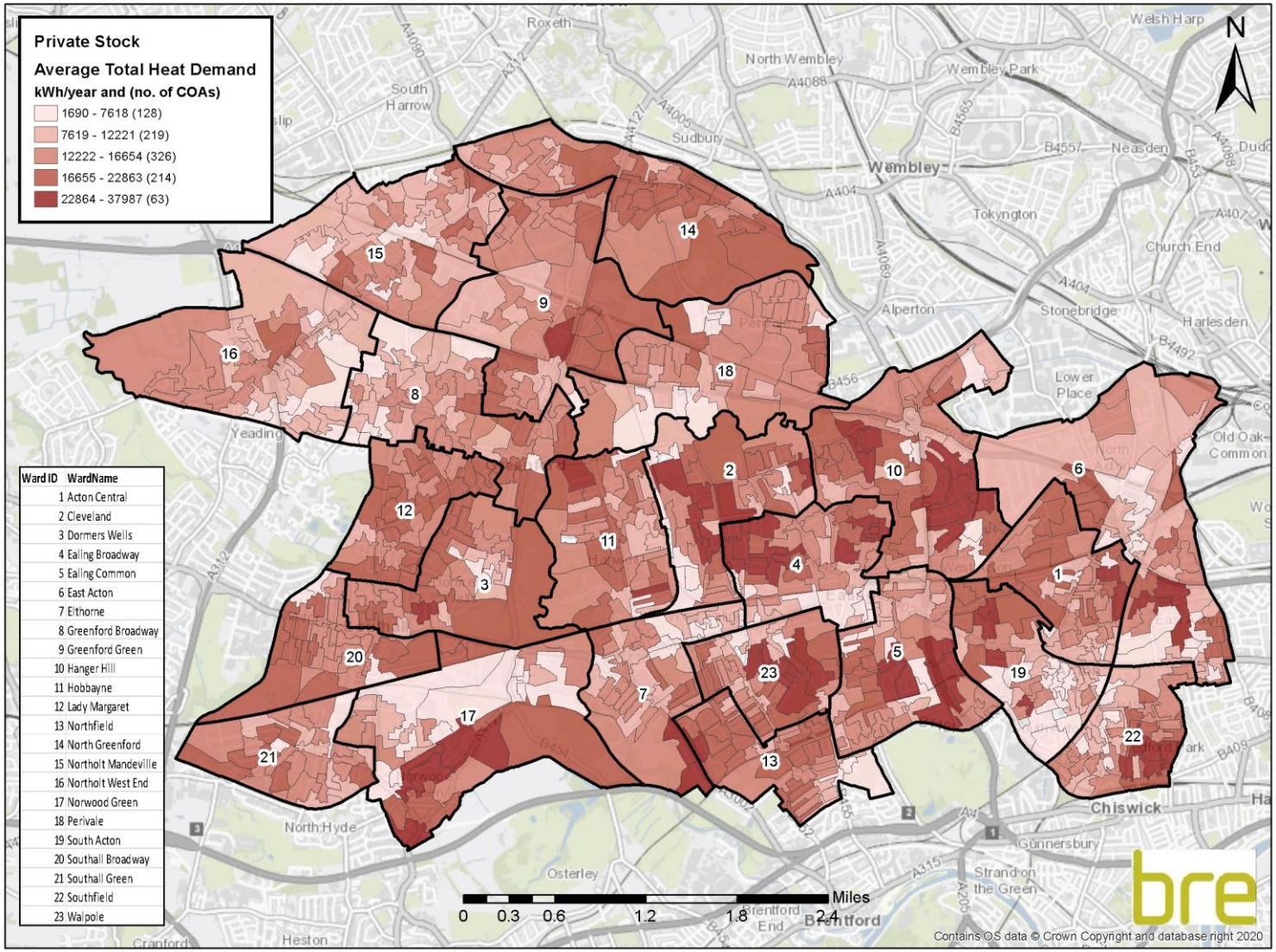
Map 21: Average total energy demand (kWh/year) – private sector stock



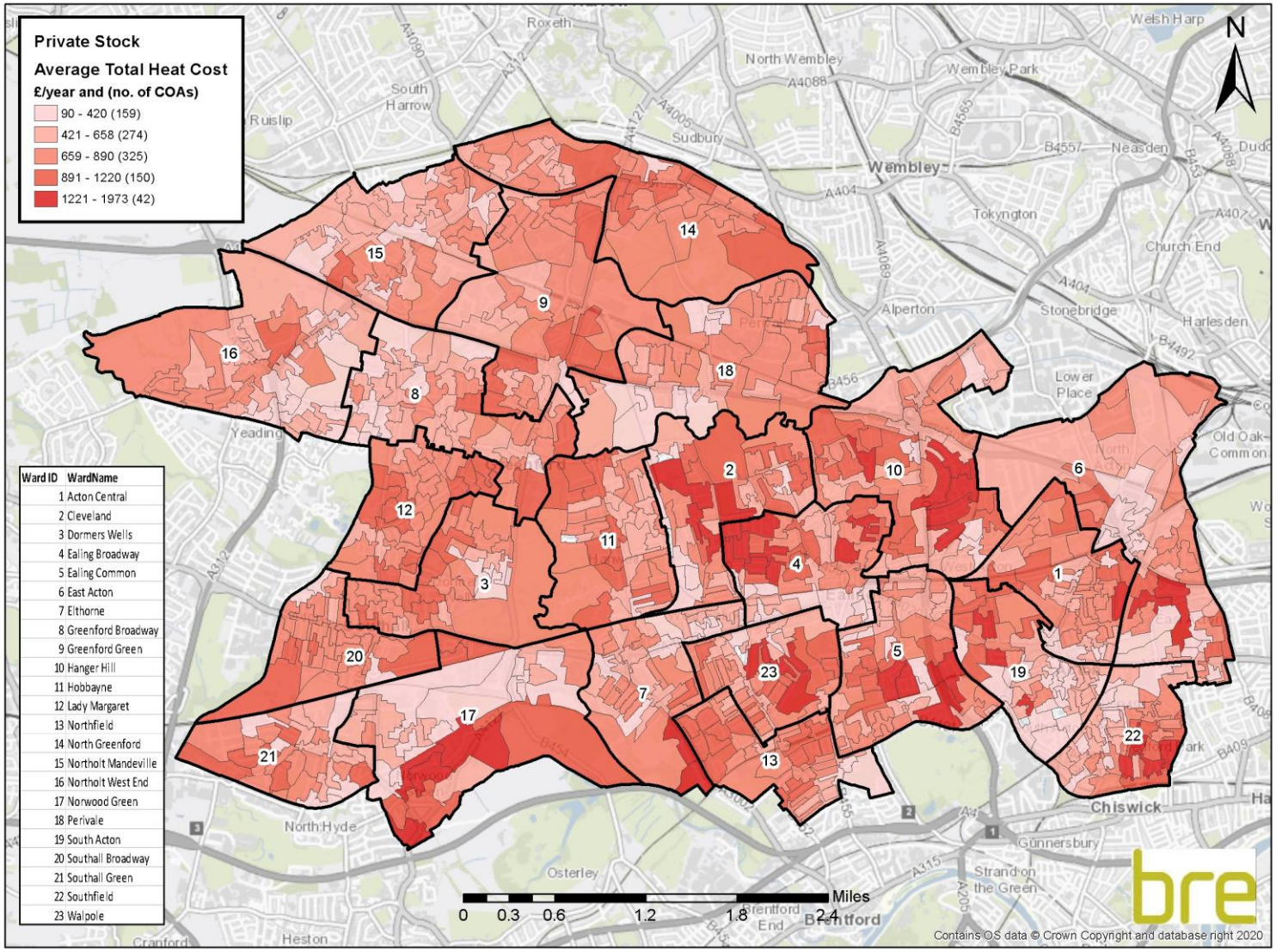
Map 22: Average total energy cost (£/year) – private sector stock



Map 23: Average total heat demand (kWh/year) – private sector stock



Map 24: Average total heat cost (£/year) – private sector stock



4.6 Improvement scenarios for Ealing

For strategic planning purposes it is helpful for local authorities to have some idea as to what energy efficiency improvements could be made to the local housing stock, what the impact of those improvements would be, and what they would cost. A total of eight improvement scenarios - examining the possibilities of improving the energy efficiency of the stock - have been produced. The improvement scenarios use various combinations of the following measures:

- Low cost measures (LCM)
- Double glazing (DG)
- Solid wall insulation (SW)
- Heating
- Solar hot water (SHW)
- Photovoltaics (PV)

Eight scenarios were constructed which use various combinations of these measures and have been selected by BRE as representative of likely packages of work undertaken to improve a property. The eight scenarios are as follows:

- Scenario 1: Low cost measures (LCM)
- Scenario 2: Low cost measures (LCM) + double glazing (DG)
- Scenario 3: low cost measures (LCM) + double glazing (DG) + solid wall insulation (SW)
- Scenario 4: Low cost measures (LCM) + heating
- Scenario 5: Low cost measures (LCM) + heating + double glazing (DG)
- Scenario 6: Low cost measures (LCM) + heating + double glazing (DG) + solid wall insulation (SW)
- Scenario 7: Low cost measures (LCM) + heating + double glazing (DG) + solid wall insulation (SW) + solar hot water (SHW)
- Scenario 8: Photovoltaics

The details of the individual measures are as follows:

Low cost measures:

- Where the dwelling has a loft but there is less than 200mm of loft insulation, add loft insulation to bring the level to 250mm
- Where the dwelling has un-insulated cavity walls, insulate them
- Where the dwelling has an un-insulated hot water cylinder, insulate it with a foam jacket
- Where the heating system does not have the most effective controls, upgrade these to effective controls

Double glazing:
The dwelling will be upgraded to have double glazing throughout.

Solid wall insulation:
Where the dwelling has solid walls, these will be insulated with external wall insulation.

Heating:
A heating system deemed to be inefficient will be replaced by a more efficient one where possible. The method for determining which systems should be replaced and what they need to be replaced with is complex, but in summary the following factors are taken into account:

- Whether the dwelling is on the gas network

- The current heating system
- The current fuel
- The size of the dwelling

Solar hot water:
This measure involves installing solar hot water panels to supplement hot water supply. Due to the difficulty in assessing the suitability of each dwelling roof the methodology simply assumes that the dwellings are suitable – therefore, the results reported here will be an over-estimate.

Photovoltaics:
This involves installing 2.5kWp photovoltaic panels. As for solar hot water, the methodology assumes all dwellings are suitable, thus resulting in an over-estimate of the savings available.

The savings estimated from each scenario are calculated by comparing them to the baseline situation for each of the energy variables (shown in **Section 4.5**, **Table 13**) and a revised SAP rating and energy consumption figures are calculated for each scenario.

Table 14 shows the impact of each of the improvement scenarios on the energy variables considered in the stock model and **Figure 12** focusses on the change in energy cost, compared to the baseline, which can be expected from each of the scenarios. It can be seen that scenario 7, which is based on the package of work with low cost measures, heating, double glazing, solid wall insulation and solar hot water, provides a large percentage of savings as follows:

- 40% reduction in average annual heating cost
- 31% reduction in average annual energy cost
- 37% reduction in average annual SimpleCO_2 emissions
- 12 point improvement in average SimpleSAP rating

It is interesting to note, however, that scenario 4, which only involves low cost measures and heating, still offers reasonable levels of savings.

The results provided here are for the total housing stock in Ealing; however, more detailed results can be generated at ward or dwelling level by using the Housing Stock Condition Database (HSCD) provided as part of this project.

Table 14: Results of the improvement scenarios analysis – showing the average change in energy output variables compared to the baseline for the total housing stock in Ealing

Scenario	Improvement measure(s)	Average improvement per property compared to baseline					
		(SimpleSAP points)	(%)				
		SimpleSAP	$SimpleCO_2$ (tonnes/year)	Energy demand (kWh/year)	Energy cost (£/year)	Heat demand (kWh/year)	Heat cost (£/year)
-	(Baseline)	59	5.13	21,370	988	12,829	640
1	LCM	+2	-6%	-7%	-5%	-8%	-8%
2	LCM + DG	+2	-8%	-8%	-6%	-10%	-10%
3	LCM + DG +SW	+8	-26%	-28%	-22%	-35%	-34%
4	LCM + heating	+5	-14%	-15%	-12%	-10%	-17%
5	LCM + heating + DG	+5	-15%	-17%	-13%	-11%	-18%
6	LCM + heating + DG + SW	+10	-32%	-35%	-28%	-36%	-40%
7	LCM + heating + DG + SW + SHW	+12	-37%	-39%	-31%	-35%	-40%
8	PV	+6	-10%	1%	-14%	1%	1%

Figure 12: Change in energy cost by scenario, including percentage change compared to the baseline

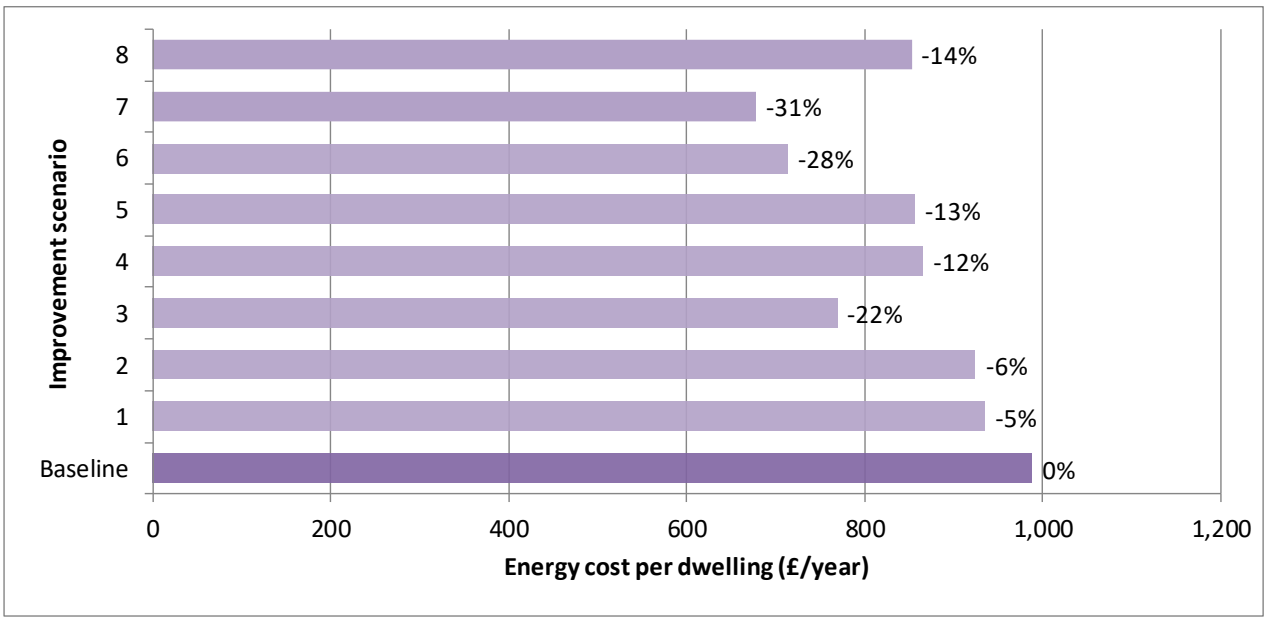
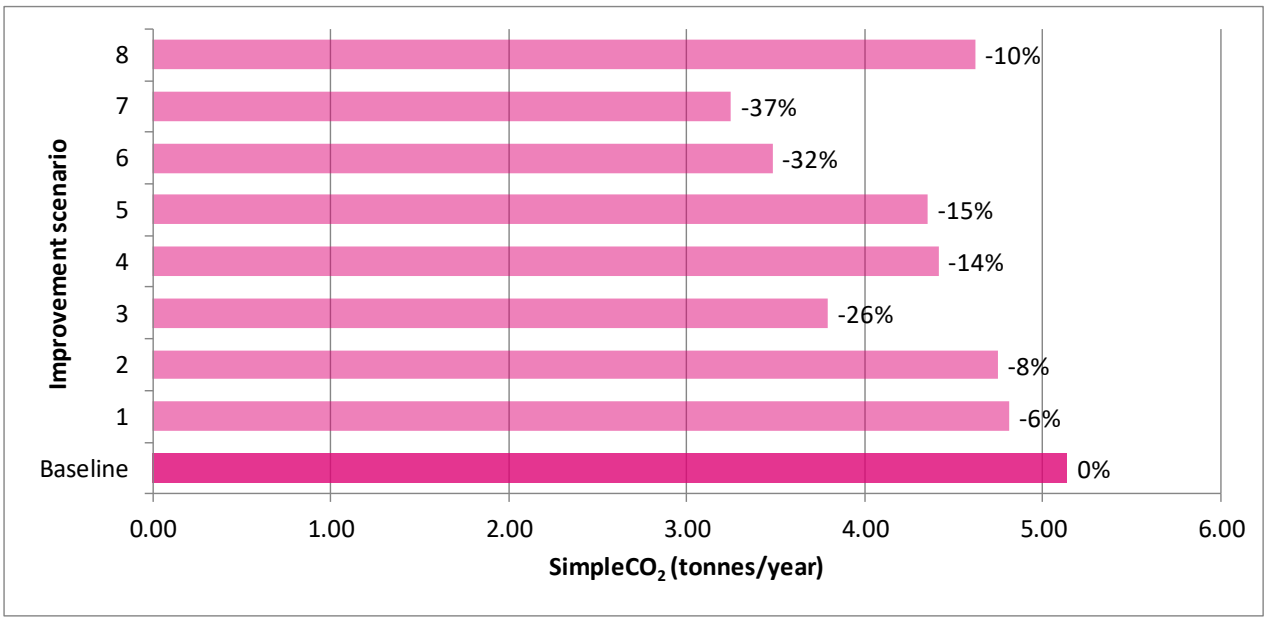


Figure 13: Change in estimated SimpleCO_2 emissions by scenario, including percentage change compared to the baseline



4.7 Estimated costs to improve the EPC rating of the stock

Ealing Council requested additional scenario modelling analysis to be undertaken to determine the work required, and the estimated potential costs required to improve SimpleSAP ratings to a) 65 and b) 70.

To do this, the improvement scenarios detailed in the previous section have been used, with each improvement scenario producing a new estimated SimpleSAP rating for each dwelling. In addition, indicative costs for each of the scenarios have also been applied for each dwelling. The cost of individual improvement scenarios will vary depending on the dwelling requirements; for example, looking at low cost measures, some dwellings may require all low cost measure to be applied, others may already have cavity wall insulation and therefore only need loft insulation improvements to be considered and costed. **Table 15** summarises the costs used for the analysis which were determined in agreement with the council.

Table 15: Summary of costs applied for each of the improvement measures

Measure		Cost	Unit
Low Cost Measure	Cavity Wall Insulation	£577 + £10/m^2	constant per dwelling + per m^2 cost
	Loft Insulation	£578 + £32/habitable room	constant per dwelling + per habitable room cost
	Cylinder Insulation	47	per dwelling
Double Glazing		£1,200 + £300 per window	constant per dwelling + per window cost
Solid Wall Insulation (external)		£2,730 + £100.54/m^2	constant per dwelling + m^2 cost
Heating	Heating	Varies	per dwelling
	Heating Controls		
Solar Hot Water		4,275	per dwelling
Photovoltics		£630 + £1,417.50/kWp	constant per dwelling + per kWp cost

4.7.1 Costs to achieve SimpleSAP of 65

Table 16 shows the results of the additional scenario modelling analysis to reach a SimpleSAP rating of 65. The scenarios are grouped into those using low cost measures plus non-heating improvements, scenarios using low cost measures plus heating improvements, and photovoltaics as a separate scenario. The baseline situation shows that 51,311 dwellings (36%) in Ealing already have an estimated SimpleSAP rating of 65 or better and therefore do not need further measures to be applied. If scenario 1 is applied, then this increases to 60,427 dwellings (42%) estimated to reach a SimpleSAP rating of 65. If scenario 2 is applied, then this increases to an estimated 62,640 dwellings (43%). Scenario 7 shows the greatest improvement, although an estimated 12% of dwellings are still not able to achieve a SimpleSAP rating of 65 based on these scenarios.

Going through **Table 16** in more detail, the number of dwellings each additional measure in the scenario is applied to in order to achieve a SimpleSAP rating of 65 varies for each scenario. For example, looking

at scenario 1, 9,116 dwellings have low cost measures installed, then looking at scenario 2 an additional 2,213 dwellings have double glazing installed.

The average cost per dwelling for each additional measure shows, in scenario 2, the average cost per dwelling to install double glazing is £3,178 and in scenario 3, the average cost per dwelling to install solid wall insulation is £13,096. It is important to note that these are average costs based on all the dwellings these measures are applied to, and the actual cost per measure for an individual dwelling could vary significantly from this average.

The total cost shows the sum of the estimated cost modelled for the improvements applied to each individual dwelling. For example, in scenario 1 the total cost for installing low cost measures is £33.58m; looking at scenario 2, the total cost for installing double glazing is £22.78m. Finally, the cumulative total cost is the estimated total cost of implementing all elements for each scenario, again modelled at individual dwelling level rather than applying averages. Using scenarios 1 and 2 as examples again, the cumulative cost to implement both low cost measure and double glazing is the sum of the total cost of each individual measure (i.e. £33.58m and £22.78m to give £56.37m cumulative total cost for scenario 2).

Table 16: Results of analysis showing estimates of numbers and proportion of dwellings reaching a SimpleSAP rating of 65 under each scenario, and estimated cost information

Scenario	Count of Dwellings reaching SimpleSAP 65	% of total dwellings	No. of dwellings each additonal measure is applied to	Avg cost per dwelling for each additional measure (£)	Total cost of each additional measure (£million)	Cumulative total cost (£million)
0. Baseline	51,311	36%	-	-	-	-
1. LCM	60,427	42%	9,116	1,205	33.58	33.58
2. LCM + DG	62,640	43%	2,213	3,178	22.78	56.37
3. LCM + DG + SW	96,218	67%	33,578	13,096	483.29	539.65
4. LCM + Heating	73,253	51%	12,826	3,181	57.43	91.01
5. LCM + Heating + DG	75,710	52%	2,457	5,164	28.65	119.66
6. LCM + Heating + DG + SW	120,495	83%	44,785	15,452	658.35	778.01
7. LCM + Heating + DG + SW + SHW	127,098	88%	6,603	20,177	600.23	1,378.24
8. Photovoltaics	76,387	53%	25,076	2,990	228.22	228.22

(N.B. scenarios are grouped into those using low cost measures plus non-heating improvements, scenarios using low cost measures plus heating improvements, and photovoltaics)

Figure 14 to **Figure 16** show the results for each set of scenarios for SimpleSAP rating of 65, again grouped into low costs measures plus non-heating improvements, those using low cost measures plus heating improvements, and photovoltaics separately – all compared to the baseline situation. They show the number of dwellings estimated to reach a SimpleSAP rating of 65 when each scenario is applied. For example, in **Figure 14**, scenario 1 shows that 60,427 dwellings can reach a SimpleSAP rating of 65. This equates to 42% of the total 144,380 dwellings in Ealing.

Figure 14: Number of dwellings with estimated SimpleSAP rating of 65 or better – low cost measures plus non-heating improvement scenarios

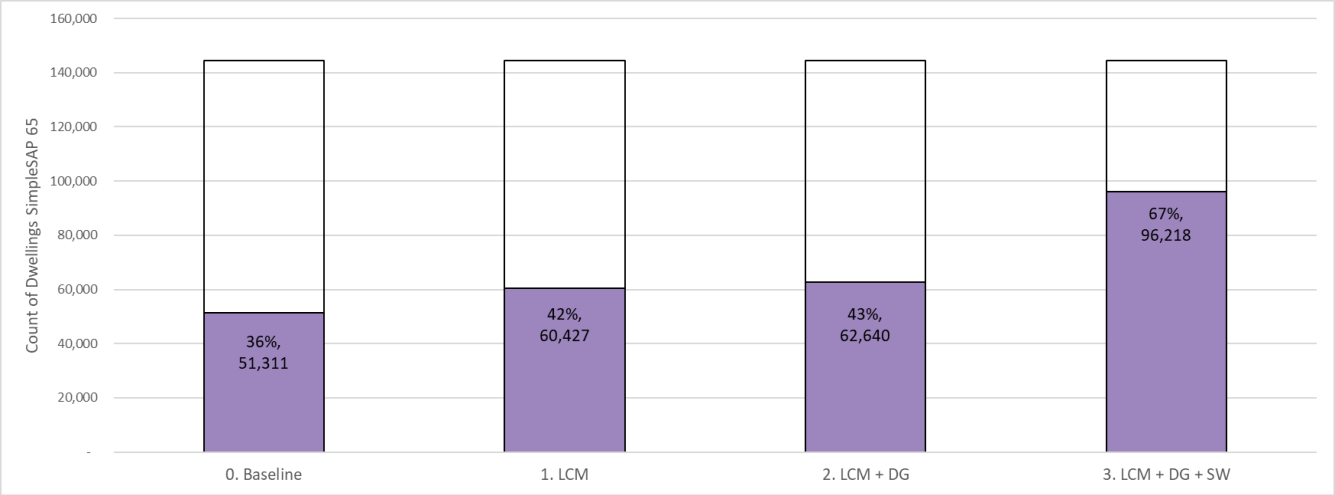


Figure 15: Number of dwellings with estimated SimpleSAP rating of 65 or better – low cost measures plus heating improvement scenarios

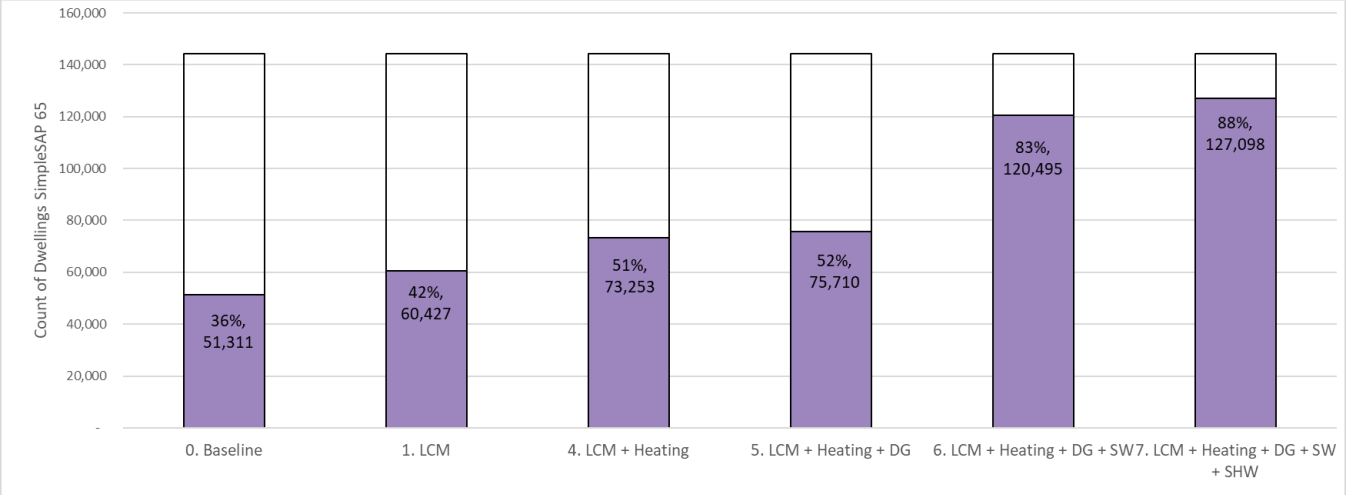
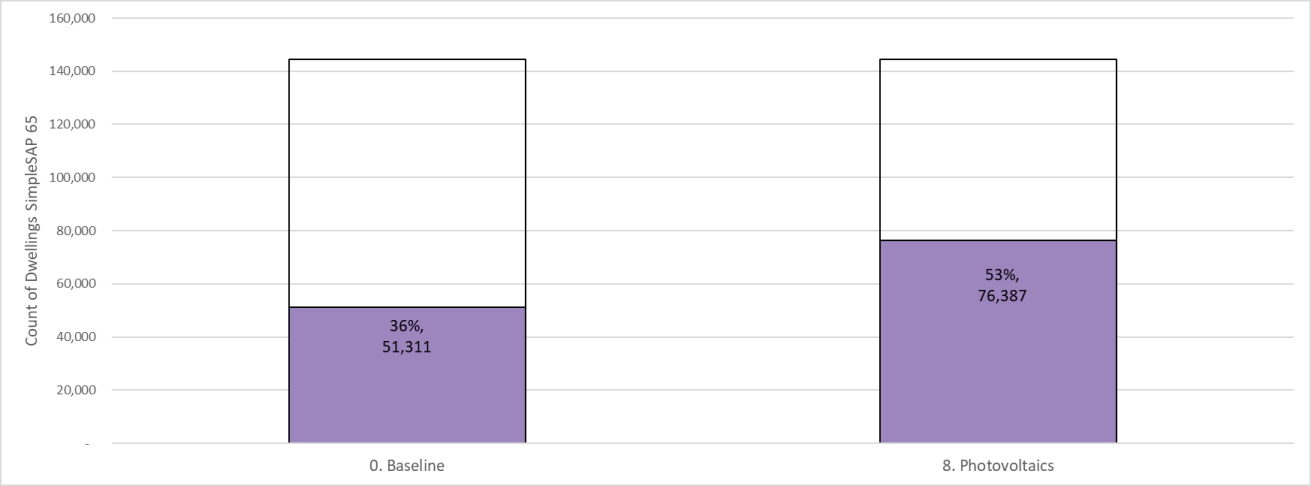


Figure 16: Number of dwellings with estimated SimpleSAP rating of 65 or better – photovoltaics scenario



4.7.2 Costs to achieve SimpleSAP of 70

Table 17 shows the results of the additional scenario modelling analysis to reach a SimpleSAP rating of 70. As before, the scenarios are grouped into those using low cost measures plus non-heating improvements, scenarios using low cost measures plus heating improvements, and photovoltaics as a separate scenario. The baseline situation shows that 32,736 dwellings (23%) in Ealing already have an estimated SimpleSAP rating of 70 or better and therefore do not need further measures to be applied. If scenario 1 is applied, then this increases to 36,465 dwellings (25%) estimated to reach a SimpleSAP rating of 70. Scenario 7 shows the greatest improvement, although an estimated 39% of dwellings are still not able to achieve a SimpleSAP rating of 70 based on these scenarios.

Table 17: Results of analysis showing estimates of numbers and proportion of dwellings reaching a SimpleSAP rating of 70 under each scenario, and estimated cost information

Scenario	Count of Dwellings reaching SimpleSAP 70	% of total dwellings	No. of dwellings each additonal measure is applied to	Avg cost per dwelling for each additional measure (£)	Total cost of each additional measure (£million)	Cumulative total cost (£million)
0. Baseline	32,736	23%	-	-	-	-
1. LCM	36,465	25%	3,729	1,142	17.25	17.25
2. LCM + DG	37,895	26%	1,430	3,096	10.49	27.76
3. LCM + DG + SW	57,086	40%	19,191	11,820	207.52	235.27
4. LCM + Heating	42,532	29%	6,067	3,099	28.12	45.38
5. LCM + Heating + DG	44,129	31%	1,597	5,070	12.63	58.01
6. LCM + Heating + DG + SW	69,447	48%	25,318	13,793	270.21	328.22
7. LCM + Heating + DG + SW + SHW	88,255	61%	18,808	18,518	416.83	745.06
8. Photovoltaics	58,327	40%	25,591	3,051	177.83	177.83

(N.B. scenarios are grouped into those using low cost measures plus non-heating improvements, scenarios using low cost measures plus heating improvements, and photovoltaics)

Figure 17 to **Figure 19** show the results for each set of scenarios for SimpleSAP rating of 70, again grouped into low costs measures plus non-heating improvements, those using low cost measures plus heating improvements, and photovoltaics separately – all compared to the baseline situation. They show the number of dwellings estimated to reach a SimpleSAP rating of 70 when each scenario is applied. For example, in **Figure 17**, scenario 1 shows that 36,465 dwellings can reach a SimpleSAP rating of 70. This equates to 25% of the total 144,380 dwellings in Ealing.

Figure 17: Number of dwellings with estimated SimpleSAP rating of 70 or better – low cost measures plus non-heating improvement scenarios

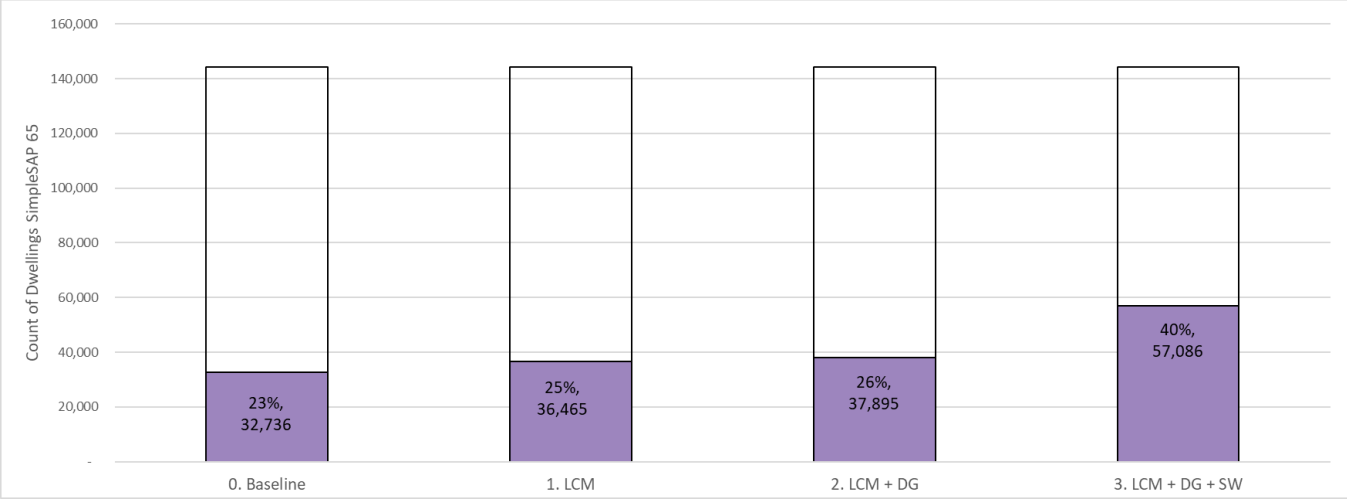


Figure 18: Number of dwellings with estimated SimpleSAP rating of 70 or better – low cost measures plus heating improvement scenarios

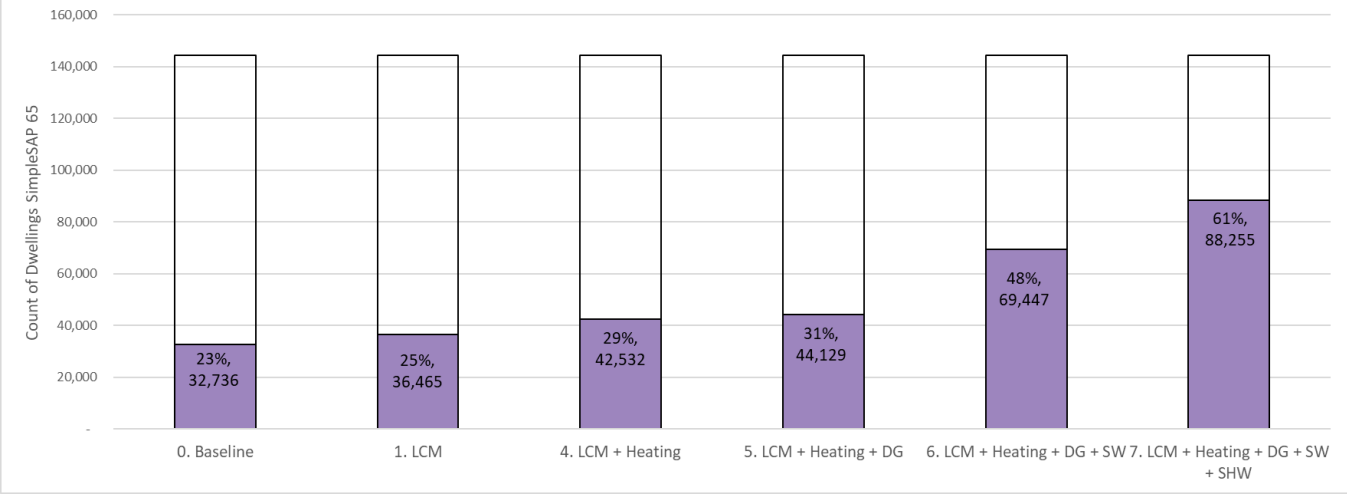
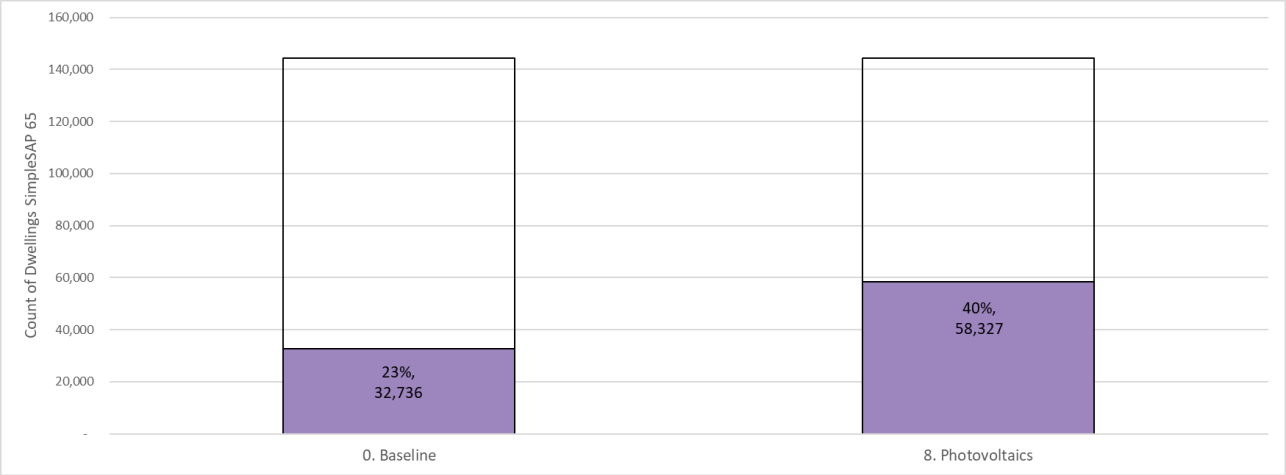


Figure 19: Number of dwellings with estimated SimpleSAP rating of 70 or better – photovoltaics scenario



5 Conclusion and recommendations

5.1 Conclusion

The London Borough of Ealing commissioned BRE to undertake a series of modelling exercises on their housing stock to provide an integrated housing stock condition database, making use of available local data sources (Local Land and Property Gazetteer (LLPG), tenure, benefits and Houses in Multiple Occupation (HMO) data including additional HMO and selective licensing data) plus the EPC data which have been integrated into BRE's standard housing stock condition database. The integration of this data source serves to further increase the accuracy of the models by removing the need to rely on imputed data for the 72,732 cases where EPC data is available, and instead using observed data from the surveys. This leads to more accurate SimpleSAP ratings, more accurate excess cold data (and therefore HHSRS data), and more accurate fuel poverty data for around 50.4% of the stock in Ealing.

This report describes the modelling work and provides details of the results obtained from the dwelling level model and database. The housing stock condition database is also provided to the council to enable them to obtain specific information whenever required. This database is now in an online format.

The integrated stock models and database provide the council with dwelling level information, focussing on private sector housing, for the following:

- The percentage of dwellings with the presence of each of the Housing Standards Variables for Ealing overall and broken down by tenure and then mapped by COA (private sector stock only) and including category 2 hazards
- Information relating to LAHS reporting for the private sector stock - category 1 hazards and HMOs as well as information on EPC ratings
- Energy efficiency for the private sector stock (wall and loft insulation)
- Energy planning variables
- Improvement scenarios
- Additional modelling analysis to determine the estimated potential costs required to improve SimpleSAP ratings to a) 65 and b) 75

Some of the key findings of this report are as follows:

- The performance of the housing stock in Ealing compared to the EHS England average is mixed with Ealing performing slightly better for all hazards, fall hazards, fuel poverty (both definitions) and low income households, but worse for excess cold, disrepair and average SimpleSAP.
- The private rented sector is generally worse than the social sector, with the exception of fuel poverty and low income households. Focussing on the tenures within the private sector stock, the owner occupied sector has higher levels of all hazards, excess cold, fall hazards and fuel poverty (10% definition), but lower levels of disrepair and fuel poverty (Low Income High Costs definition). The private rented stock has a notably higher proportion of low income households compared to the owner occupied stock.
- 5.3% of dwellings in the private rented sector are estimated to have an EPC below band E. Under the legislation these properties would not be eligible to be rented out to new or renewal tenancies. From 1 April 2020 this also applies to existing tenancies.

Such information will facilitate the decision making process for targeting resources to improve the condition of housing and to prevent ill health resulting from poor housing conditions. Furthermore, the

results of this project provide Ealing with information which will assist in housing policy and strategy development whether these are inspired locally, arise from obligations under the Housing Act 2004 or as responses to government initiatives such as MHCLG's Housing Strategy Policy and ECO.

5.2 Recommendations

Programmes designed to tackle disrepair for example group repair schemes, regeneration or enforcement interventions could be considered with a focus on areas of greatest disrepair in the private sector such as Walpole ward with 8% disrepair and 13% containing category 1 hazards, or Acton Central ward with an estimated 7% of private sector homes in disrepair and 10% with category 1 hazards. These findings could be combined with local intelligence to help identify additional areas for targeting assistance for physical improvements to private sector stock and the environment. Furthermore, programmes aimed at increasing household income through job creation, benefit entitlement checks and other initiatives could also be considered, with a particular focus on areas containing high proportions of low income households like Southall Green (25%), Southall Broadway (24%) and Acton Central (22%).

The use of additional local data in this project has enhanced the housing stock models and Housing Stock Condition Database (HSCD). The addition of any further local data, were it to become available, would potentially further enhance the models and database.

- **Local repair schemes**

Data from any local repair schemes, including the use of repair grants, could be used to enhance the Disrepair Model.

- **Local energy improvement schemes**

Any local schemes to improve the energy efficiency of dwellings, including national schemes for which local data has been made available, could be used to further enhance the energy models (SimpleSAP, excess cold, fuel poverty).

bre

Appendix A Definitions of the Housing Standards Variables

1. **Housing Standards Variables:**
   a. **The presence of a category 1 hazard under the Housing Health and Safety Rating System (HHSRS) – reflecting both condition and thermal efficiency**
   Homes posing a category 1 hazard under the HHSRS – the system includes 29 hazards in the home categorised into category 1 – band A to C (serious) or category 2 – band D onwards (other) based on a weighted evaluation tool. Note that this includes the hazard of excess cold which is also included as one of the energy efficiency variables.

   The 29 hazards are:

1 Damp and mould growth	16 Food safety
2 Excess cold	17 Personal hygiene, Sanitation and Drainage
3 Excess heat	18 Water supply
4 Asbestos	19 Falls associated with baths etc.
5 Biocides	20 Falling on level surfaces etc.
6 Carbon Monoxide and fuel combustion products	21 Falling on stairs etc.
7 Lead	22 Falling between levels
8 Radiation	23 Electrical hazards
9 Uncombusted fuel gas	24 Fire
10 Volatile Organic Compounds	25 Flames, hot surfaces etc.
11 Crowding and space	26 Collision and entrapment
12 Entry by intruders	27 Explosions
13 Lighting	28 Position and operability of amenities etc.
14 Noise	29 Structural collapse and falling elements
15 Domestic hygiene, Pests and Refuse	

   b. **The presence of a category 1 hazard for falls (includes "falls associated with baths", "falling on the level" and "falling on stairs")**
   The HHSRS Falls Model includes the 3 different falls hazards where the vulnerable person is over 60 as listed above.

   c. **Dwellings in disrepair (based on the former Decent Homes Standard criteria for Disrepair)**
   The previous Decent Homes Standard states that a dwelling fails this criterion if it is not found to be in a reasonable state of repair. This is assessed by looking at the age of the dwelling and the condition of a range of building components including walls, roofs, windows, doors, electrics and heating systems).

2. **Energy efficiency variables:**
   a. **The presence of a category 1 hazard for excess cold (using SAP ratings as a proxy measure in the same manner as the English House Condition Survey)**
   This hazard looks at households where there is a threat to health arising from sub-optimal indoor temperatures. The HHSRS assessment is based on the most low income group for this hazard – persons aged 65 years or over (note that the assessment requires the hazard to

be present and potentially affect a person in the low income age group should they occupy that dwelling. The assessment does not take account of the age of the person actually occupying that dwelling at that particular point in time).

The English Housing Survey (EHS) does not measure the actual temperatures achieved in each dwelling and therefore the presence of this hazard is measured by using the SAP rating as a proxy. Dwellings with a SAP rating of less than 33.52 (SAP 2012 methodology) are considered to be suffering from a category 1 excess cold hazard.

b. An estimate of the SAP rating which, to emphasise its origin from a reduced set of input variables, is referred to as "SimpleSAP"

The Standard Assessment Procedure (SAP) is the UK Government's standard methodology for home energy cost ratings. SAP ratings allow comparisons of energy efficiency to be made, and can show the likely improvements to a dwelling in terms of energy use. The Building Regulations require a SAP assessment to be carried out for all new dwellings and conversions. Local authorities, housing associations, and other landlords also use SAP ratings to estimate the energy efficiency of existing housing. The version on which the Average SAP rating model is based is SAP 2012.

The SAP ratings give a measure of the annual unit energy cost of space and water heating for the dwelling under a standard regime, assuming specific heating patterns and room temperatures. The fuel prices used are the same as those specified in SAP 2012. The SAP takes into account a range of factors that contribute to energy efficiency, which include:

- Thermal insulation of the building fabric
- The shape and exposed surfaces of the dwelling
- Efficiency and control of the heating system
- The fuel used for space and water heating
- Ventilation and solar gain characteristics of the dwelling

3. Household vulnerability variables:

a. Fuel poverty - 10% definition

This definition states that a household is said to be in fuel poverty if it spends more than 10% of its income on fuel to maintain an adequate level of warmth (usually defined as 21^{o}C for the main living area, and 18^{o}C for other occupied rooms). This broad definition of fuel costs also includes modelled spending on water heating, lights, appliances and cooking.

The fuel poverty ratio is defined as:

$$\textit{Fuel poverty ratio} = \frac{\textit{Fuel costs (usage * price)}}{\textit{Full income}}$$

If this ratio is greater than 0.1 then the household is in fuel poverty.

The definition of full income is the official headline figure and in addition to the basic income measure, it includes income related directly to housing (i.e. Housing Benefit, Income Support for Mortgage Interest (ISMI), Mortgage Payment Protection Insurance (MPPI), Council Tax reduction).

Fuel costs are modelled, rather than based on actual spending. They are calculated by combining the fuel requirements of the household with the corresponding fuel prices. The key goal in the modelling is to ensure that the household achieves the adequate level of warmth set out in the definition of fuel poverty whilst also meeting their other domestic fuel requirements.

b. Fuel poverty - Low Income High Costs definition

The Government has recently set out a new definition of fuel poverty which it intends to adopt under the Low Income High Costs (LIHC) framework[58]. Under the new definition, a household is said to be in fuel poverty if:

- They have required fuel costs that are above average (the national median level)
- Were they to spend that amount they would be left with a residual income below the official poverty line

c. Dwellings occupied by a low income household

A household in receipt of:

- Income support
- Housing benefit
- Attendance allowance
- Disability living allowance
- Industrial injuries disablement benefit
- War disablement pension
- Pension credit
- Child tax credit
- Working credit

For child tax credit and working tax credit, the household is only considered a low income household if it has a relevant income of less than £16,105.

The definition also includes households in receipt of Council Tax reduction and income based Job Seekers Allowance.

4. Category 2 hazards:

According to the strict definitions of the HHSRS a category 2 hazard is any hazard that is not a category one hazard. This definition, however, would identify all dwellings without a category 1 hazard, even those that were generally considered safe. Instead the definition is restricted to hazards of band D or E, with the exception of the falls on the level hazard, where only consider band D is considered (as E is the average rating for falls on the level).

[58] https://www.gov.uk/government/collections/fuel-poverty-statistics

Appendix B Methodology for the BRE Integrated Dwelling Level Housing Stock Modelling approach

This Appendix provides a more detailed description of the models which make up the overall housing stock modelling approach and feed into the housing stock condition database. The process is made up of a series of data sources and Models which, combined with various imputation and regression techniques and the application of other formulae, make up the final Housing Stock Condition Database (HSCD). The database is essentially the main output of the modelling and provides information on the Housing Standards Variables and other data requirements (e.g. energy efficiency variables). An overview of the approach and a simplified flow diagram are provided in **Section 3** of this report.

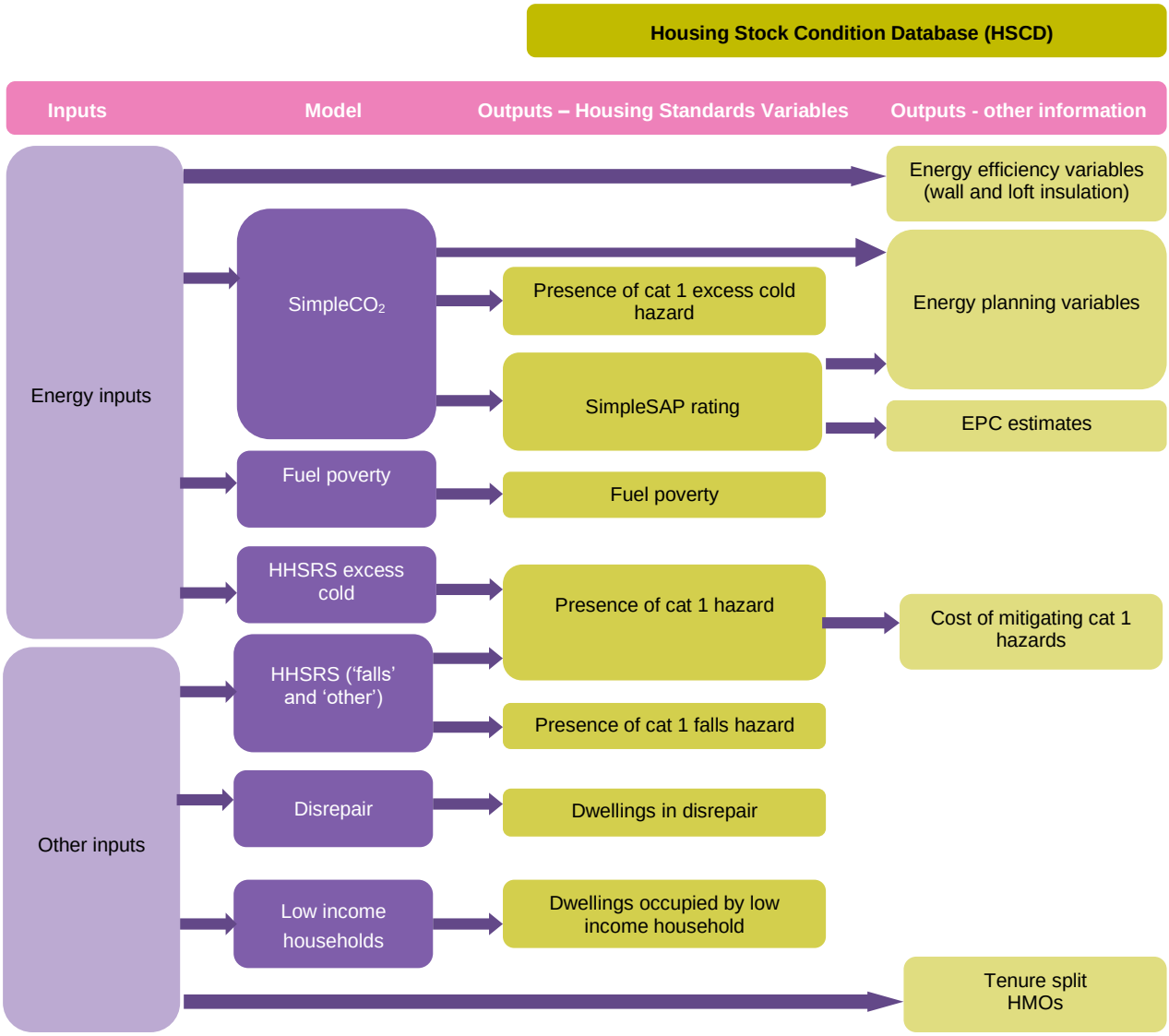
The models making up the overall housing stock modelling approach are:

- SimpleCO_2 Model
- Fuel Poverty Model
- HHSRS (all hazards, falls hazards and excess cold) Models
- Disrepair Model
- Low Income Households Model

Figure B.1 shows the data flows for the stock modelling approach, showing which models each of the outputs in the database (split into the Housing Standards Variables and other information) come from. The exception is the energy efficiency variables (if used) which come directly from the energy inputs, and the tenure and HMO data (if used) which come directly from the other inputs.

Section B.1 describes the SimpleCO_2 Model in more detail, **Section B.2** provides more information on the other four models and **Section B.3** gives details of the OS MasterMap/geomodelling approach.

Figure B.1: Simplified data flow for the housing stock modelling approach



B.1 BRE SimpleCO_2 Model

BRE have developed a variant of the BREDEM[59] software, named "SimpleCO_2", that can calculate outputs from a reduced set of input variables. These outputs are indicative of the full BREDEM outputs and the minimum set of variables the software accepts is information on:

- Tenure
- Dwelling type
- Location of flat (if a flat)
- Dwelling age
- Number of storeys
- Number of rooms
- Loft insulation
- Level of double glazing
- Main heating type
- Boiler type (if a boiler driven system)
- Heating fuel
- Heating system
- Heating controls
- Water heating
- Hot water cylinder insulation
- Solar hot water
- PV panels
- Internal floor area

The Experian UK Consumer Dynamics Database is used as a source for some of these variables (tenure, dwelling age) and they are converted into a suitable format for the SimpleCO_2 software. The dwelling type is derived using information from OS Mastermap and the number of storeys from OS experimental height data. The remaining pieces of data are inferred from the EHS using other tenure, dwelling age and type, other Experian data (number of bedrooms), other OS data (i.e. dwelling footprint) and data from Xoserve[60] which indicates whether the dwelling is in a postcode which is on the gas network. As the characteristics of a dwelling cannot be determined through access to observed data, a technique known as cold deck imputation is undertaken. This is a process of assigning values in accordance with their known proportions in the stock. For example, this technique is used for predicting heating fuels because the Xoserve data only confirms whether a dwelling is on the gas network or not. Fuel used by dwellings not on the gas network is unknown, so in most cases this information will be assigned using probabilistic methods. The process is actually far more complex e.g. dwellings with particular characteristics such as larger dwellings are more likely to be assigned with oil as a fuel than smaller dwellings.

[59] Building Research Establishment Domestic Energy Model, BRE are the original developers of this model which calculates the energy costs of a dwelling based on measures of building characteristics (assuming a standard heating and living regime). The model has a number of outputs including an estimate of the SAP rating and carbon emissions.

[60] Xoserve is jointly owned by the five major gas distribution Network companies and National Grid's gas transmission business. It provides transportation transactional services on behalf of all the major gas Network transportation companies.

The reason for taking this approach is to ensure that the national proportions in the data source are the same as those found in the stock nationally (as predicted by the EHS or other national survey). Whilst there is the possibility that some values assigned will be incorrect for a particular dwelling (as part of the assignment process has to be random) they ensure that examples of some of the more unusual types of dwelling that will be present in the stock are included.

Whilst this approach is an entirely sensible and commonly adopted approach to dealing with missing data in databases intended for strategic use, it raises issues where one of the intended uses is planning implementation measures. It must therefore be kept in mind at all times that the data provided represents the most likely status of the dwelling, but that the actual status may be quite different. That said, where EPC data has been used, the energy models (which use EPC data) are likely to be more accurate.

It is important to note that some variables have been entirely assigned using cold decking imputation techniques. These include presence of cavity wall insulation and thickness of loft insulation as there is no reliable database with national coverage for these variables.

The "SimpleCO_2" software takes the combination of Experian and imputed data and calculates the "SimpleSAP" rating for each dwelling in the national database. The calculated "SimpleSAP" ratings are the basis of the estimates of SAP and excess cold. How the other key variables are derived is discussed later in this Appendix.

Because the estimates of "SimpleSAP" etc. are calculated from modelled data it is not possible to guarantee the figures. They do, however, provide the best estimates that we are aware can be achieved from a data source with national coverage and ready availability. The input data could, however, be improved in its:

- accuracy for example through correcting erroneous values,
- depth of coverage, for example by providing more detailed information on age of dwellings,
- breadth by providing additional input variables such as insulation.

Improving any of these would enhance the accuracy of the output variables and for this reason it is always worth considering utilising additional information sources where they are available. Using EPC data will go some way towards meeting these improvements by providing more accurate data.

B.2 Housing Condition and Low Income Household Models

This section provides further information on the remaining four models – fuel poverty, HHSRS, disrepair and low income households. These models are discussed together since the approach used for each one is broadly the same.

These models are not based solely on the thermal characteristics of the dwelling, and in some cases are not based on these characteristics at all. A top down methodology has been employed for these models, using data from the EHS and statistical techniques, such as logistic regression, to determine the combination of variables which are most strongly associated with failure of each standard. Formulae have been developed by BRE to predict the likelihood of failure based on certain inputs. The formulae are then applied to the variables in the national Experian dataset to provide a likelihood of failure for each dwelling. Each individual case is then assigned a failure/compliance variable based on its likelihood of failure and on the expected number of dwellings that will fail the standard within a given geographic area. Thus if the aggregate values for a Census Output Area are that 60% of the dwellings in the area fail a particular standard then 60% of the dwellings with the highest failure probabilities will be assigned as failures and the remaining 40% as passes.

The presence of a category 1 hazard failure is the only exception to this as it is found by combining excess cold, fall hazards and other hazards such that failure of any one of these hazards leads to failure of the standard.

B.3 Integrating local data sources

As mentioned in the main body of the report, Ealing identified a number sources of data which were used to update the BRE dwelling level models to provide an integrated housing stock condition database. Their data sources are shown in **Table B.1**.

To allow these data sources to be linked to the BRE Dwelling Level Stock Models, an address matching exercise was required to link each address to the Experian address key. Address matching is rarely 100% successful due to a number of factors including:

- Incomplete address or postcodes
- Variations in how the address is written e.g. Flat 1 or Ground floor flat
- Additions to the main dwelling e.g. annexes or out-buildings

Experience indicates that, for address files in good order, match rates are around 75% - 95%. **Table B.1** provides the address matching results for the six data sources provided by Ealing and the resulting impact on the modelling process.

Table B.1: Address matching results and impact on the modelling process

Data source	Total no. of records	No. (and %) of addresses matched	Notes / impact on the modelling process
EPC data	101,336 – total records available	72,732 (88% of de-duplicated)	Data de-duplicated for multiple EPCs – 82,905 remaining Final number matched to modelled data and useable – 72,732
LLPG data	174,057 – total received	144,380 (83% of records provided)	BLPU classes and address fields checked and duplicate UPRNs removed – 144,380 remaining
Tenure data	21,226 – total received	19,436 (91% of records provided)	19,436 – remaining records after de-duplication
Benefits data	19,494 – total received	17,974 (92% of records provided)	Remaining cases once duplicate UPRNs removed – 17,974
HMO and Selective Licensing data	10,144 – total received	9,478 (93% of records provided)	Remaining cases once duplicate UPRNs removed – 9,478

The Housing Stock Condition Database (HSCD) was also updated using the Ordnance Survey (OS) MasterMap data which enables the measurement of the footprint of the building and provides information on the number of residential addresses within the building, and to see which other buildings each address is attached to or geographically close to.

The stage at which the local data sources are included in the modelling process depends on whether or not the data includes information which can be used as an input into the SimpleCO_2 model. The simplified flow diagram in **Figure 1** in the main report shows how these data sources are integrated into the standard modelling approach.

The following sections consider each of the data sources and how they are used to update the SimpleCO_2 inputs and/or stock model outputs.

EPC data

If there are discrepancies in the energy data for the same dwelling case, arising from different energy data sources, then, if available, the EPC data will be used. If no EPC data source is available for that case, then the data with the most recent date will be taken.

Some of the energy data provided includes tenure data, in which case the housing stock condition database has been updated accordingly. However, EPC cases do not include tenure data, they only include the reason for the EPC.

Therefore:

- If the reason given was a sale then the dwelling was assumed to be owner occupied.
- If the reason given was re-letting and the tenure of the let was specified (i.e. private or social) then the tenure was changed to that indicated.
- If the reason for the sale did not indicate tenure then the tenure was left unchanged.

It is important to note that the modified tenure created from the EPC data should only ever be used for work relating to energy efficiency and carbon reduction. This is a legal requirement stemming from the collection of the data, and is a licence condition of the data suppliers, Landmark. For this reason, the tenure variable supplied in the database is NOT based on EPC data; however, the calculations used to determine the SimpleSAP rating and other energy characteristics of the dwelling do make use of the EPC tenure.

Where the energy data provides information on loft insulation, wall insulation, the location of a flat within a block and floor area this information will be used in favour of any imputed information, as long as the OS data is in agreement with the dwelling type.

Where energy data on wall type is present for a dwelling in a block of flats, terrace or semi-detached, that data is extrapolated to the rest of the block or terrace. If multiple dwellings with energy data are present then the most common wall type is used. Note that where the energy data indicates a wall type that is not the predominant one, this data will not be overwritten with the predominant type – the data reported in the energy database will always be used even if this results in two different wall types being present in a terrace or a block of flats.

For flats it is assumed that all flats in the block will have the same level of double glazing and as the case for which we have energy data for. If there are multiple flats in the block with energy data showing different levels of double glazing, an average will be used.

It is assumed that all flats in a block share the same heating type, boiler type if present, fuel type and heating controls. Where there are multiple types present, the predominant type is used. Flats are

assumed to have the same hot water source, and if one flat benefits from solar hot water it is assumed that all flats in the block do.

B.4 OS MasterMap information

OS AddressBase was then linked to the OS MasterMap Topography Layer. OS MasterMap provides a detailed geographical representation of the landscape in Great Britain, including buildings. Once the OS AddressBase is linked to OS MasterMap it is possible to extract the relevant geographical information for the residential buildings – this involves looking at information about individual dwellings or blocks of flats such as footprint area and attachment to other dwellings.

Figure B. 2 shows that visual identification of dwelling type can be quite simple. The OS MasterMap of the cul-de-sac 'Prince of Wales Gardens' comprises 10 sets of semi-detached properties. BRE use this type of knowledge to create a model to infer dwelling type, which is described in more detail below.

Figure B. 2: OS MasterMap example (source OS website[61])

By looking at the number of residential address points (from OS AddressBase) it is possible to determine whether a building is a house or a block of flats[62]. The dwelling type is then determined based on the spatial relationship of the individual dwelling/block of flats with other dwellings. These spatial relationships are outlined for each resulting dwelling type below:

[61] https://www.ordnancesurvey.co.uk/business-and-government/products/mastermap-products.html

[62] Houses have one residential address point and blocks of flats have two or more

Houses - where the dwelling is a house, the number of other buildings it is attached to can be observed and the dwelling types allocated as follows:

Detached – where a single address is within a dwelling footprint and that footprint is not attached to any other building footprint[63].

Semi-detached - where a single address is within a dwelling footprint and is joined to one other building footprint.

Terrace - where three or more building footprints are joined to one another.

Mid terrace – where a single address is part of a terrace block and attached to more than one other building footprint.

End terrace – where a single address is part of terrace block and attached to only one other building footprint.

Flats - if the building is a block of flats, its exact nature is determined by its age and the number of flats in the block. The following assumptions are made:

Converted flat –if there are between two and four flats in the block (inclusive) and the dwelling was built before 1980 then it is assumed to be a conversion.

Purpose built flat – all other flats are assumed to be purpose built.

[63] The area of land over which a building is constructed (i.e. the area of the ground floor only, this does not take into account the number of floors in a building)

Appendix C Using the BRE Integrated Dwelling Level Housing Stock Database

The BRE Housing Stock Condition Database (HSCD) is the final output of the overall stock modelling approach described in **Section 3** and **Appendix B**. The HSDC has been designed to allow local authorities to access their local area data. There are a number of different options for summarising or investigating the data and generating lists of properties of interest.

C.1 Overview

The Housing Stock Condition Database (HSCD) is now online. You can access it in https://hscd.bregroup.com/login.jsp with the credentials sent to you by email.

To ensure data security the interface will automatically open on the login page shown in **Figure C. 1**. Should you forget your password details, these can be reset and emailed to you using the function provided on the login page.

Upon login, the home page will open with a dashboard showing the Housing Standards Variables for your housing stock, similar to that shown in

Figure C. 2.The navigation pane is along the top and is visible on all pages; the options shown on the navigation pane will depend upon the options purchased.

Figure C. 1: Login screen

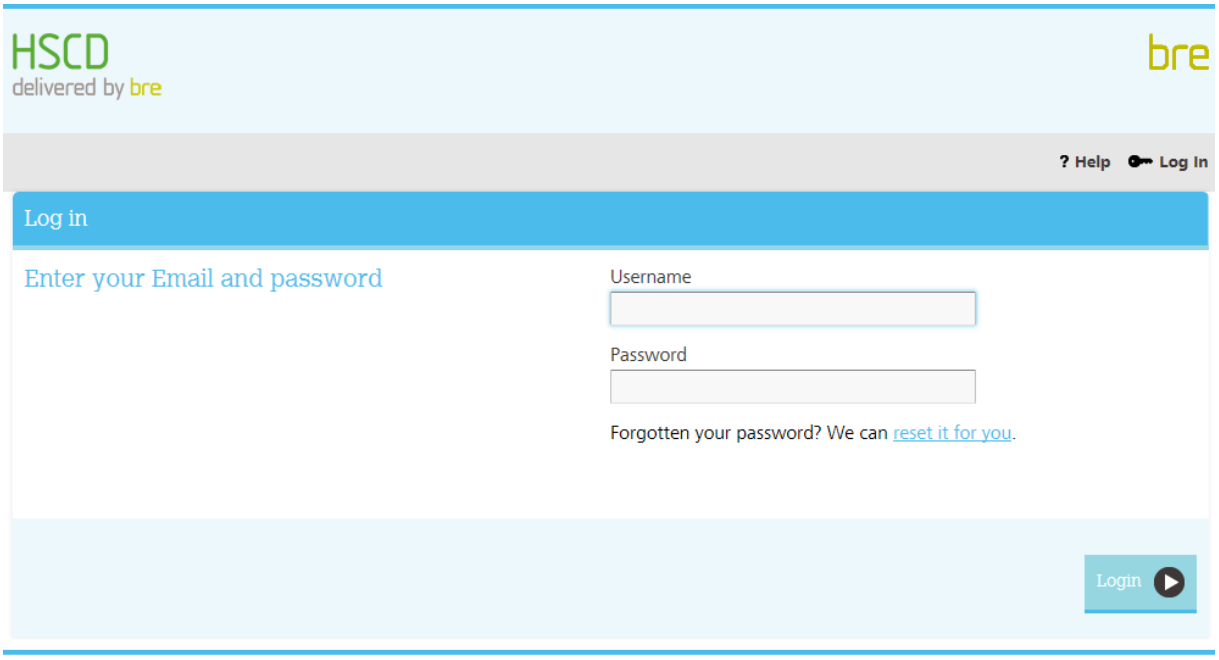
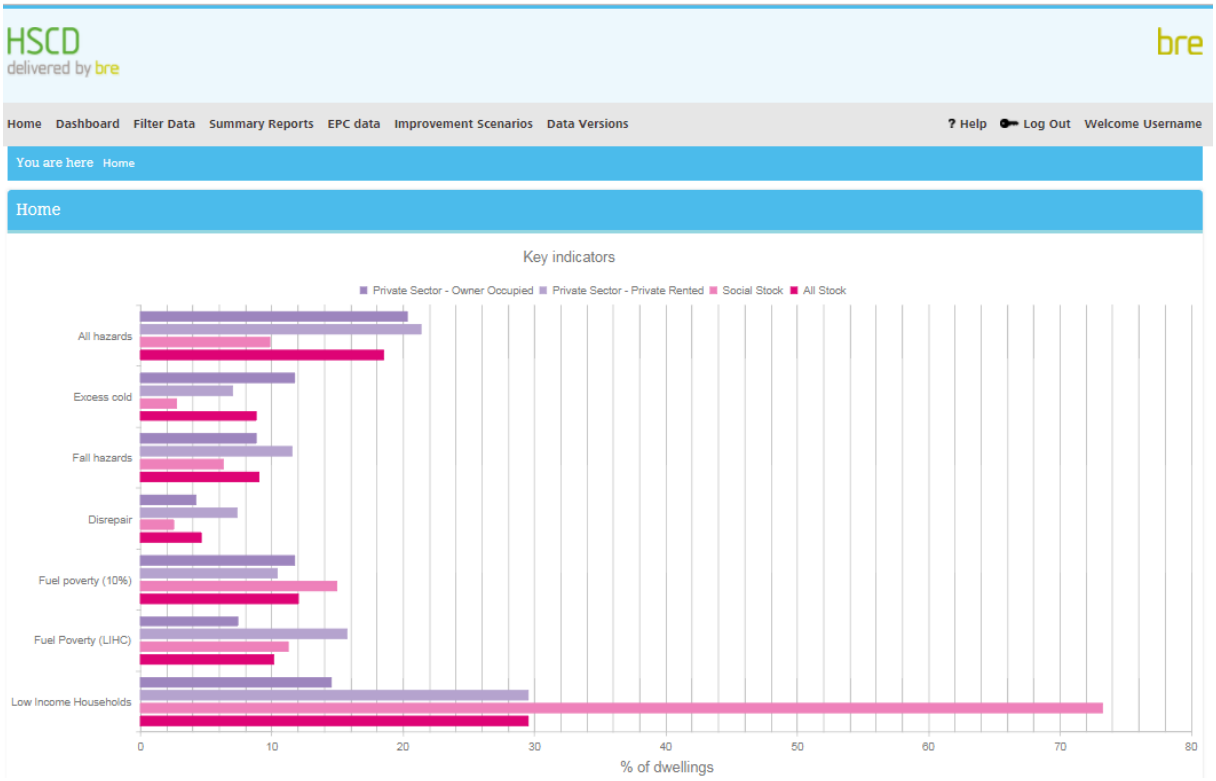


Figure C. 2 Home page (note screenshot below is sample data)



Please refer to the user guide accessible via the log in page under the help button.

Glossary of terms

BREDEM	BRE Domestic Energy Model
Category 1 hazard	Hazards with a HHSRS score of > 1,000. A dwelling with a category 1 hazard is considered to fail the minimum statutory standard for housing
Category 2 hazard	Other, less serious hazards which a local authority can take action on at their discretion
CLG	Department for Communities and Local Government
COA	Census Output Area
	Designed for statistical purposes, built from postcode units, approximately 125 households
Disrepair	Based on former Decent Homes Standard criteria which states that a dwelling fails this if it is not in a reasonable state of repair – this is based on the dwelling age and condition of a range of building components including walls, roofs, windows, doors, electrics and heating systems
ECO	Energy Companies Obligation
	Places legal obligations on the larger energy suppliers to deliver energy efficiency measures to domestic energy users
EHS	English Housing Survey
	A continuous national survey commissioned by the Ministry of Housing, Communities and Local Government (MHCLG). It collects information about people's housing circumstances and the condition and energy efficiency of housing in England
EPC	Energy Performance Certificate
	Present the energy efficiency of domestic properties on a scale of A (most efficient) to G (least efficient)
Fuel poverty	The original definition of fuel poverty states that a household is in fuel poverty if it needs to spend more than 10% of their income on fuel to maintain an adequate level of warmth (10% definition). The new definition now adopted by government is that a household is said to be in fuel poverty if they have fuel costs that are above average and were they to spend that amount they would be left with a residual income below the official poverty line (Low Income High Costs definition)
GIS	Geographic Information System
	A system designed to capture, store, manipulate, analyse, manage and present spatial or geographical data
HHSRS	Housing Health and Safety Rating System

	A risk assessment tool to help local authorities identify and protect against potential risks and hazards to health and safety related deficiencies in dwellings, covering 29 categories of hazards
HIA	Health Impact Assessment A formal method of assessing the impact of a project, procedure or strategy on the health of a population
HMO	Houses in Multiple Occupation An entire house or flat which is let to 3 or more tenants who form 2 or more households and who share a kitchen, bathroom or toilet A house which has been converted entirely into bedsits or other non-self-contained accommodation and which is let to 3 or more tenants who form two or more households and who share kitchen, bathroom or toilet facilities A converted house which contains one or more flats which are not wholly self-contained (i.e. the flat does not contain within it a kitchen, bathroom and toilet) and which is occupied by 3 or more tenants who form two or more households A building which is converted entirely into self-contained flats if the conversion did not meet the standards of the 1991 Building Regulations and more than one-third of the flats are let on short-term tenancies In order to be an HMO the property must be used as the tenants' only or main residence and it should be used solely or mainly to house tenants. Properties let to students and migrant workers will be treated as their only or main residence and the same will apply to properties which are used as domestic refuges
HSM	Housing Stock Model Desktop based modelling used to determine the condition of the housing stock
Jenks' Natural Breaks	The natural breaks classification method is a data clustering method determining the best arrangement of values into different classes. It is achieved through minimising each class's average deviation from the class mean while maximising each class's deviation from the means of the other groups. The method seeks to reduce the variance within classes and maximise variance between classes thus ensuring groups are distinctive
JSNA	Joint Strategic Needs Assessment An assessment of the current and future health and social care needs of the local community
LACORs	Local Authority Coordinators of Regulatory Services – now renamed Local Government Regulation

LAHS	Local Authority Housing Statistics National statistics on housing owned and managed by local authorities
LIHC	Low Income High Cost Measure of fuel poverty, considers a household to be in fuel poverty if required fuel costs are above average, or if they were to spend that amount they would be left with a residual income below the official poverty line
LLPG	Local Land and Property Gazetteer An address database maintained by local authorities
LSOA	Lower Super Output Area Designed for statistical purposes, built from Census Output Areas, approximately 400 households
MHCLG	Ministry of Housing, Communities and Local Government
MSOA	Medium Super Output Area Designed for statistical purposes, built from Lower Super Output Areas, approximately 2,000 households
NHS	National Health Service
Older people	People over 65 for the excess cold hazard, people over 60 for the fire and fall hazards (excl. falling between levels)
OS	Ordnance Survey
Poor housing	Dwellings where a category 1 hazard is present
Private sector housing	Housing not owned by the local authority or a housing association
SAP	Standard Assessment Procedure Method system for measurement of energy rating of residential buildings.
SimpleSAP	An estimate of a residential dwelling's likely SAP score, it is not based on the full required range of data for a SAP calculation or a reduced data SAP calculation (RDSAP), it should only ever be considered an estimate of the SAP score, and used as a guide
UPRN	Unique Property Reference Number A unique 12 digit number assigned to every unit of land and property recorded by local authorities as part of their LLPG
Vulnerable persons	Persons who are more likely to be affected by the particular hazard as defined by the HHSRS Operating Guidance