



University of  
**Salford**  
MANCHESTER



**SHUSU**  
SUSTAINABLE HOUSING  
& URBAN STUDIES UNIT

## Erneley Close Passive House Retrofit

**Resident experiences and building  
performance in retrofit to  
passive house standard**



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## About One Manchester

One Manchester is a provider of housing and community services. Formed in April 2015 from an historic merger between two of Manchester's largest housing associations – City South and Eastlands Homes, we currently own and manage more than 12,000 homes in central, south and east Manchester.

As an experienced and trustworthy landlord, we provide good quality homes that are safe, secure, warm and affordable, and we are proud to be known as a housing association. However, we believe that our responsibilities go much further than providing homes. Our view is that housing associations are all about place-making. We regularly look at the issues which go beyond housing and especially those that are specific to each of our communities. We help people manage their money, find work, start-up businesses and stay healthy and well.  
(Text provided by One Manchester)

## About the authors

The Sustainable Housing & Urban Studies Unit (SHUSU) is a dedicated multi-disciplinary research and consultancy unit providing a range of services relating to housing and urban management to public and private sector clients. The Unit brings together researchers drawn from a range of disciplines including: social policy, housing management, urban geography, environmental management, psychology, social care and social work.

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# 1. Introduction



In May 2015, Eastlands Housing (now One Manchester) completed work on its retrofit to PassivHaus equivalent (EnerPHit) standard of 32 social housing flats in two blocks in Erneley Close, in the Manchester area Gorton. With a budget of £3.1 million, it was intended that the development would reduce energy bills, create new community greenspace and make the area a destination of choice (PassivHaus Trust 2015).

Over the period December 2015 to February 2016, researchers at the Sustainable Housing and Urban Studies Unit (SHUSU) and the Applied Buildings and Energy Research Group (ABERG) monitored the thermal performance of the buildings and interviewed residents to understand their experiences of both the retrofit process and living in their retrofitted-flats. The research contributes to a nascent literature on retrofit of social housing to EnerPHit levels and to a broader literature base on processes and outcomes of retrofit across the UK housing stock. It finds broadly positive outcomes

from the Erneley Close improvements, with monitoring indicating high expected comfort levels and the majority of tenants expressing satisfaction with the thermal performance of the flats and the heating systems. As with any major development, there are lessons that can be learnt, and opportunities to enhance the work: these relate primarily to ensuring residents, including vulnerable groups, understand fully how to get the best out of their retrofitted flats; and addressing some non-energy related tenant concerns.

The report begins with an overview of the EnerPHit standard (Chapter 2), before outlining the methodology (Chapter 3). Chapters 4 and 5 present the findings from the qualitative interviews and the physical monitoring respectively. Finally, Chapter 6 offers a set of recommendations that relate to this and future social housing energy retrofit.

## 2. The Passive House & EnerPHit standards



The International Passive House Association (iPHA) offers three main forms of certification - the Passive House standard, the EnerPHit standard and the PHI Low Energy Building Standard (Passive House Institute, 2016). All three require candidate buildings to achieve energy efficiency benchmarks, although the criteria differ.

Although detailed technical assessments must be completed to reach the Passive House standard, The Passive House Institute (PHI) provides a functional definition rather than a scientific measure, stating that:

A Passive House is a building, for which thermal comfort (ISO 7730) can be achieved solely by post-heating or post-cooling of the fresh air mass, which is required to achieve sufficient indoor air quality conditions – without the need for additional recirculation of air. (Passive House Institute, 2016, online)

The EnerPHit standard was specifically devised for retrofits (iPHA, 2014), whilst the Passivhaus standard was primarily designed with new builds in mind. The use of a separate designation recognised that the owners of properties increasingly wanted to refurbish ‘according to Passive House principles’, but that it was not always

practically possible to reach exactly the same level of efficiency due to the existing design and structure of the buildings. The EnerPHit standard ‘makes allowances for this’ (ibid: 31), permitting properties to record a higher KWH demand per square metre than those seeking the Passive House Standard or requiring them to use ‘Passive House components for all relevant structural elements’ (Passive House Institute, 2016: 7). Like the Passive House standard, complex technical testing is required by any property applying for EnerPHit certification.

The PHI Low Energy Building Standard has less stringent criteria than either Passive House or EnerPHit but still demands that a set of challenging targets are met, many of which are shared with the latter.

As a retrofit, but still seeking the maximum energy efficiency, the Erneley Close refurbishment aimed to achieve the EnerPHit standard (Casey Ltd, 2012). It was awarded this certification in 2015.

## 2.1 Passive House and EnerPHit properties in the UK

There are databases that list buildings recognised as having achieved the Passive House or EnerPHit standards in the UK. However, the overwhelming majority of records consist of new build, small scale (under 20 units), privately owned properties. Furthermore, even among the minority of schemes which have been developed within the social housing sector, single household dwellings remain the norm, with multiple occupancy, apartment style buildings exceptional. At the time of writing, a search located two separate internet based directories. A number of developments appear on both databases.

The PassivHaus Trust UK site (an affiliate of the iPHA) records nearly 100 examples of properties in the UK (as of February 2017). Twenty developments occurred in the social housing sector, seventeen of which were new builds. Of the three retrofits, Octavia Housing had refurbished a single Victorian terraced house in London to the 'retrofit for the future' standard (completed 2011). The other two properties attained the EnerPHit standard - Orbit Heart of England Housing refurbished a single semi-detached house in Wellesbourne, Warwickshire in 2011, while Erneley Close in Manchester is the only listed retrofit development of significant size, encompassing multiple properties and households.

A more comprehensive record is held by the Passive House Database which catalogues 4,000 buildings across 48 countries, (as of February 2017), that have attained certification, including retrofit schemes attaining the EnerPHit standard. Drilling down produces 99 UK records of properties classed as Passive House, EnerPHit or low energy with Passive House components. A number of developments appear on both databases.

Overall ten schemes listed on the database were delivered by social housing providers. These were in Coventry and Wellesbourne, Warwickshire (Orbit Heart of England); South Cambridgeshire (Hastoe Housing Association); Saffron Walden (provider unknown); Standings Court, Horsham (Saxon Weald Housing Association); Wilmcote House in Portsmouth, (Portsmouth City Council); Exeter, (Exeter City Council); Dungannon, Northern Ireland (Oaklee Homes Group); Orkney (Orkney Housing Association) and Erneley Close Manchester (One Manchester).

As with the Passivhaus Trust's database, the majority listed are new builds, constructed to the Passive House standard. In terms of larger scale projects, the development in Exeter consisted of 18 apartments, completed in 2011, while a terrace of five two storey flats in Dungannon, Northern Ireland was completed in 2012. The developments in Saffron Walden, Horsham and Orkney were also new builds. That at Saffron Walden (completed 2011) comprised a mix of fourteen houses and apartments, in Horsham (2012), twelve homes of

three and four bedrooms, and a pair of semidetached dwellings completed in 2014 in South Cambridgeshire. A single property in Orkney was refurbished to the Passive House standard in 2014. The new build in Coventry, a mixture of five houses and eighteen flats, was built to low energy 'with Passive House components' standard and completed in 2011.

Only the developments in Portsmouth, Manchester and Warwickshire were certified EnerPHit retrofits accomplished in the social housing sector. The latter, Elliot Drive in Wellesbourne (the same property as listed on the Passivhaus Trust's database) consisted of a single dwelling. Wilmcote House in Portsmouth was a refurbishment of three, eleven storey tower blocks to EnerPHit standard, constructed in 2015 by Keepmoat.

At the time of writing, therefore, only two social housing providers have undertaken large scale projects aimed at renovating existing structures according to Passive House principles. It is clear that Passive House projects within the social housing sector are not only rarer but are also mainly characterized by small scale, new build operations intended for single household occupancy. This may reflect a number of factors – the conscious mitigation of risk, limited initial funding, size of the provider's stock, or simply because the project was a pilot and intended to be small scale. Eastland's Erneley Close scheme was, therefore, radical on a number of fronts when first described in 2012, not least in the scale of the challenge in terms of the number of properties and their pre-existing condition. The only existing comparison is the programme undertaken by Portsmouth City Council.

## 2.2 Why is it of value to One Manchester?

Undoubtedly the rarity of Passive House properties which are a) social housing sector and b) retrofits, present significant opportunity for building managers to break new ground in both fields. The potential benefits are notable. Clearly the financial savings to be made in energy costs to both landlord and residents over the longterm are advantageous. By being among the first to undertake this, there are opportunities for publicity and recognition as a sector leader in energy efficiency, providing a model for other social housing organisations. This is already evident through examples such as publications on supporting older people in Passive House residences (Lewis, 2015). This reputational impact may have other spin offs in terms of attracting academic and policy makers to the site. On a more local level, it provides One Manchester with the template should they wish to roll the approach out to other housing schemes in their portfolio.

# 3. Methodology



## 3.1 Tenant interviews

The first component of this study comprised a set of nine qualitative semi-structured interviews with tenants of Erneley Close carried out by researchers from the field of energy and social science in May 2016. With the permission of the tenants, all interviews were audio recorded and transcribed verbatim. Following ethical guidelines, the interview transcripts were stored and reported in a way that made it impossible to associate any particular comments with an individual name or address. Analysis was carried out using NVivo qualitative analysis software to identify themes arising and to compare and contrast the views of the residents. The results are given in Chapter 4.

The interviewees were selected in liaison with One Manchester staff, and the questions for the interviews were drawn up from a series of meetings with key people involved in the retrofit development. The team sought to recruit a set of tenants that could provide a reasonable representation of the themes and issues arising through the entire retrofit process, including design and consultation, decanting, and returning to and living in the property. To this end, the sample includes male and female tenants, white British and other ethnic groupings, households with and without children, single-person and multiple households, and those who experienced decanting as well as those who moved in following retrofit.

This qualitative interview approach facilitates a deep exploration of the experiences of a group of tenants. Semi-structured interviews allow for a relatively free-flowing conversation based around a pre-prepared topic guide, allowing for unanticipated issues to arise and causality to be explored. The approach tends to identify a set of themes and issues applicable to the researched field, rather than quantifications and statements of statistical significance and generalizability. It is worth noting that such an approach can be vulnerable to participant biases. One such bias is referred to as 'negativity bias', which is well known in the field of psychology and tends to reflect the notion that 'humans are more attentive to and more influenced by the negative aspects of their environment than by the positive' (Haizlip et al 2012: 1205). It is important to bear this in mind when exploring tenant reactions to upheavals concerning their home, as often there are many factors that can be seen as disruptive and different, even if the outcomes of retrofit are largely positive (Sherriff and Martin, 2016; Karvonen 2013).



## 3.2 Monitoring

The second component of the research comprised monitoring of physical characteristics of the properties in order to assess their thermal performance following retrofit. Small wireless sensors were installed in seven sample flats in December 2015. The monitoring continued until February 2017. The choice of monitoring period reflected a need to understand the performance of the flats across the seasons. A summary of the results is given in Chapter 5.

The sensors monitored:

- Air temperature (°C) and Relative Humidity (%) in 3 areas:
  - Lounge
  - Hallway
  - Bedroom
- CO<sub>2</sub> in ppm (parts per million), in the Lounge area
- Electricity (kWh) used by the MVHR (Mechanical ventilation and heat recovery) system.

The dataset is largely complete; there are a few instances where the data was unrecorded due to technical problems, but overall the data integrity is particularly high. Periods of unrecorded data are easily identifiable in the data files. No gap filling with simulated data has been necessary as the gaps constitute such a small proportion of the total data.



Figure 1 - Community space at the front of the building

# 4. Findings: Interviews



## 4.1 Introduction

This chapter presents an overview of findings from the interviews. It is structured in three sections:

- The Passive House system,
- The Property (interior and exterior); and
- The External Environment.
- The Decanting Process

Each section is further divided into three themes:

- Understanding & Communication;
- Experience; and
- Choice and Control.

These were selected after a close reading of the interview transcripts indicated that they were re-occurring themes in residents' responses.

### 4.1.1 Sample

We interviewed nine households in total. Four interviewees were women and five men. In terms of household size, three of the interviewees were in single person households, (SU1, SU3, SU5), four in two-person households (SU6, SU7, SU8 & SU9), and two households contained three people (SU2, SU4).

Three interviewees had children under 16 currently living with them (SU2, SU4, SU6). Although we did not collect data on which age bracket individuals (and where relevant, their co-residents) belonged to, we were able to identify that three individuals were retired, while another four (SU3, SU6, SU7, SU8) were employed. Five had lived at Erneley Close before redevelopment, with the remaining four having moved in subsequently.

**Table 1 - Interviewees**

code	Length of residence at time of survey (months / years)	Male / female	Decant (D) Non-Decant (ND)	No. in household
SU1	15/16 years	Female	D	1
SU2	2 years	Male	ND	3
SU3	20 years	Male	D	1
SU4	1 year 3 months	Female	ND	3
SU5	6 years	Male	D	1
SU6	1 year 6 months	Female	ND	2
SU7	Ten years	Female	D	2
SU8	1 year	Male	ND	2
SU9	17 years	Male	D	2

## 4.2 The Passive House system

### 4.2.1 Introduction

This section concentrates specifically on the Passive House system. It explores residents' understanding of the concept, how well they felt informed about it and what conversation and other forms of communication occurred between residents and One Manchester about the new heating technology and its operation.

### 4.2.2 Understanding & Communication

#### Information provision

There was clear evidence that substantial amounts of information about the Passive House system had been communicated to residents at different stages of the development. Several interviewees used the term Passive House itself, or were familiar with it when prompted (e.g. SU1, SU2, SU4, SU5, SU9). As one interviewee remarked: *'The passive housing, it was all explained to me'* (SU5).

One of the ways in which information was communicated to residents was a comprehensive information booklet explaining the operation of the system (published April 2014). Almost all the residents we spoke to demonstrated awareness of this booklet, even if they had not read it in detail, and had a working understanding of the principles behind the heating system.

Well, I know we received a big pack regarding the energy system. I was also told that it's kind of self-sufficient. I was told the benefits around filtering the air, the fan system that we can obviously choose ourselves how fast the fans work in (the) event if we're cooking food or it gets too warm and it can generate the air faster round the house. (SU6)

Interviewees confirmed that information on the benefits of Passive House had also been communicated to them. Three stated they had been told it would help them save on energy (SU1, SU8, SU7) – for example *'you'll have doors that keep the heat in...'* (SU7). A number displayed quite detailed knowledge of the working of the system – their references to 'they said' or 'they told us' indicating that their understanding had been supplied by One Manchester either verbally or in the form of printed literature. In addition, most could recall other opportunities such as open days and information stalls on the central communal court, general meetings prior to work starting, or initial visits by workers demonstrating how to operate the domestic interface when they moved in (or back to) their flat. Individual liaison staff were mentioned as sources of information and communication, before, during and after renovation.

...there was loads of leaflets that they gave me as well and they were always on hand if I needed any advice or wasn't sure on anything. (SU6)

Similarly, another resident said that if he had any queries regarding the system he would call the One Manchester helpline:

...then if it's something that they should talk me through on the phone they will talk me through. If they need to send someone, they will send someone. (SU8)

#### Understanding the system

While the interviews suggested that a substantial amount of information had been provided, and specific instances of communication about Passive House could be recalled, this had not necessarily translated into a complete understanding. Some residents demonstrated only a partial awareness of the Passive House system.

When asked if they had clearly understood the new installation, one example is instructive: after commenting that *'they [One Manchester] went through the heating and this booklet and everything'* the same interviewee, when asked to describe how Passive House worked in practice, stated *'It's all a bit technical to me. I don't know'* (SU1). Others we spoke to, while confirming they had received *'plenty of information'*, tempered the comment by adding *'but none of us really got the scientific part... and, to be honest, it was very high tech for a lot of people round here'* (SU7).

When questioned why the renovation had been undertaken in the first place, the same residents emphasised a need for a general physical makeover as much as the installation of the Passive House system, although it was acknowledged that they had received information on the new system. This may of course, be a fair reflection of the balance of information that was transmitted to residents, particularly those who had lived at Erneley Close before the work started and had been involved in the consultation process.

Even when residents did display a reasonable understanding of Passive House, the issue of how much of the information supplied was actually taken on board and then applied to the management of their system was highlighted by the comments of a number of individual residents. One respondent who confirmed he had been told all about the new heating system, admitted it had *'been in one ear and out the other'* (SU5). Nevertheless, this was no bar to managing the heating system effectively on a day to day basis. The same resident described it as *'common sense'* to operate. Another resident, (SU4), who acknowledged she only had *'a bit of an idea of the whole thing'*, even though the system had been explained to her three times, also confirmed that she had no problem understanding or operating it. This may indicate not only that some technical aspects of communication around the system were less effective than intended, but also that they are less valuable to residents than more simple practical 'day to day use' guidance. This may be useful learning for future projects of a similar nature.

For some, learning was an evolving process. One man described how at first he hadn't followed the instructions and instead had tinkered with the dials and been unable to achieve a stable indoor climate. As a result, he repeatedly altered the dial until someone came and told him *'just leave it this way, it will adjust itself'*. He stated that if he or his co-tenant had any issues with the system they would call the One Manchester helpline, adding that he needed to read the booklet properly but overall it was *'easy to manage'* (SU8). For these individuals, a mixture of confidence in their own ability and some basic experimentation appeared to be sufficient. An illustrative parallel may be the basic familiarization with technical manuals when installing a DVD player or washing machine. For these residents, an adequate working knowledge appeared to be enough.

It cannot be assumed, however, that such trial and error approaches are producing the optimum results in terms of managing the indoor climate. Some interviewees, for example, appeared far less sure about how to use the system and clearly struggled with the technical aspects.

The process was, we all went over to the show house and some guy literally just showed us how to use it. That was absolutely no good for anyone. We didn't understand. We were all asking questions and, 'Right, off you go with the booklet'. Myself and my partner finally got it after about two or three days of reading'. (SU7)

This comment demonstrates both the active engagement carried out by One Manchester Homes and the potential for information to miss its intended target. This resident took it upon themselves to find out more, and comments indicate others did likewise. Lewis's conclusion is valid here: *'Ultimately, occupants will adapt to living in a Passivhaus dwelling through hands-on experience, and it should be noted that even occupants who were provided with little or inadequate guidance have developed competency in managing thermal comfort in their homes.'* (Lewis 2015: 23)

### Different experiences

Although the sample was small, the evidence suggests an age divide in terms of understanding what the system was about, with younger residents far more comfortable with the principles and the operation. An exception to this was an older man, whose background in skilled engineering may explain his lack of difficulty. Aside from the communication between One Manchester and residents (whether individually or collectively), many referred to the conversations which they had had with partners, neighbours or friends regarding the new system. When this involved older residents the narrative tended to be negative, with several different interviewees mentioning that older people had struggled to understand the new system (SU1, SU7, SU5). One stated:

The majority were elderly. I think the younger ones understood it, but they've had more trouble over that side than this side with different things. (SU1)

Overall, all the residents we interviewed acknowledged that substantial amounts of information had been given to them. However, there was a division between those who could explain the principles with a degree of confidence, and also had no difficulty operating it, and those who were less sure. There was some evidence this was partly due to the sheer amount of information, and the technical level it was pitched at:

We were given the booklet for the MHVR system which, to be quite honest, was very technical and more of an engineer's booklet than a lay person's booklet. I tried to glean as much as I could from it but I was reliant on diagrams really. (SU3)

For some residents however, Passive House was not their primary interest, with information on interior fittings or features of the external environment more of a priority. This aspect of personal choice may well be important in terms of understanding how and why people absorb information on different subjects and why even with extensive communication, levels of awareness may differ widely among a small group presented with the same messages.

Should One Manchester consider comparable (or other large scale) schemes, careful consideration of how key messages are communicated, and whether segmentation of the residents to target those most at risk of struggling to understand with appropriate methods would be fruitful in terms of ensuring a good standard of awareness. While it is likely that older people are more vulnerable in this regard overall, no assumptions can be made as other factors may be at play – for example, two older male residents, who had both worked in skilled trades picked up the operating principles with some degree of ease, whereas those without such practical background found the process of absorbing information much more challenging.

### 4.2.3 Experience of Passive House

#### Comfort

*'Yes, I know, it's lovely. It's like this all the time, even in winter it's like this'* (SU1). This comment was far from unique amongst the interviewees and the experience of using the new system and living in a Passive House-induced climate was described in overwhelmingly positive terms. Most said they rarely touched the interfaces and had little need to because the climate was invariably comfortable.



It's very good. We don't have to use the heating at all.

Interviewer: At all? How do you find the indoor temperature? I don't know if you use a thermometer.

It's perfect. It's never too hot and it's never cold. Perfect. (SU4)

This echoed a statement from a resident in the adjacent block, who remarked that they only used the heating about ten times a year and there were some months in which they had never turned it on. A third had only turned it on approximately twenty times in eighteen months. Those who had lived in Erneley Close before renovation contrasted the current climate with that in the old blocks. Comments included:

Previously, when we were here... on a day like this, we would [be] in this room, be sat with coats and, oh my God. Oh, it was horrendous and when we came in here, it's like, wow. It was different. It was warm. It was all warm but it was nice. (SU7)

Two others, (SU1, SU9), remarked that the air was much cleaner now than before the retrofit. For those who had moved in after the work had been completed, comparison was made with other dwellings they had lived in. The contrast was similarly favourable, whether

with private rented accommodation or One Manchester properties elsewhere. Two compared their current residence positively to cold and damp former properties (SU2, SU8). When asked to describe the atmosphere in their home another resident who arrived after renovation stated:

It is very fresh when you come in. If it's absolutely scorching outside, I always come in and it's nice and cool. It can, to be fair, feel very stuffy, like there's no air from time to time. (SU6)

The word 'fresh' was used to describe the climate by more than one resident, but as this quote demonstrates, the experience could be nuanced. Several pointed out that the internal climate could become uncomfortable and get unbearably hot when the direct sun was shining on the windows (SU3, SU5, SU6, SU9). This included residents who otherwise rated it highly.

### Differing experiences

Despite the small sample, there was some indication that experience (or at least perception) appeared to differ depending on household size. All those in households of two or more were highly complementary about the



Figure 2 - Booklet provided to residents (cover)

internal climate, whereas single occupants were more equivocal. One single occupant complained that the inflow of cold air via the ceiling regularly left them feeling cold (SU3). Another single householder suggested that there was a cause and effect between the number of people in a house and the efficacy of the Passive House system (SU5), while an interviewee in a two person setup said they clearly noticed it getting warmer when visitors came around, and commented that they had been told the system **'generates off our own energies, so you could massively tell when other people were in'** (SU6).

Only three interviewees expressed significant reservations about the new heating system and it may be relevant that two were in adjacent properties. One of these, (SU3), acknowledged that the climate had been very good when they had visited other residents' properties, while the second conceded the climate in their flat was much better than before, even if not as good as they had expected. The latter (SU7) said they weren't putting the heating on because they couldn't afford to while a third said it was costing them much less than before, but that they weren't using it out of concern that they would incur significant expense (SU5). This resident (SU5) explicitly stated they were spending three times their previous amount on hot water, and this was also mentioned by another interviewee (SU9). However, as heating bills do not differentiate the costs of domestic hot water (DHW) and general space heating, there may have been an element of confusion with previous systems. No interviewee stated they were paying more to heat the rooms, and only one said it was about the same (SU3).

### Managing Energy bills

A number of residents mentioned the experience of 'topping up' using prepayment cards. Two residents commented that if they topped the card up on a Friday, the heating did not come on until Monday. One interviewee had had ongoing problems with the card, where their payments appeared not to register, and regularly called the helpline to try and resolve the re-occurring issue.

Every time, every week they will try to put £5 for me. When it's going to run out I will call them until they sort it out. (SU8)

Interestingly, the resident (SU5) who described the energy rates as very expensive, said he had heard from others that they were spending **'tonnes'** of money topping up the cards. He himself, however, was spending less, and we did not identify anyone else in the sample spending large amounts. One individual who had had a pre-payment meter in their previous property (not located in Erneley Close) stated **'we don't top it up that much compared to how we used to pay over there'** (SU4), and three others who specially mentioned topping up were also paying much less than they had before (SU6, SU8, SU9). Significantly in this regard, satisfaction

was expressed at the notable reduction in fuel bills. One resident confirmed that not having to pay for gas had saved her £100 a month (SU6), while others also highlighted a significant drop in fuel bills (SU5, SU1, SU4, SU7, SU8).

### Wellbeing

It is also notable that three of the nine respondents attributed a specific health benefit to the new indoor climate, all referring to significant improvements in a family member's asthma condition since living in the renovated flats.

Yes, wellbeing. Much, much (better)- because where I was to where I am now it's an upgrade. It's much, much better because I'm asthmatic as well so it's a lot better for me. (SU8)

A significant improvement in general wellbeing was also mentioned by other residents (SU2, SU4, SU5 and SU6).

You can understand it, the difference, so when you're living in a cold house you always get cold, always get chest infections, so many infections, but when you move out and you move into this kind of property, well-being and health will be all right (SU2).

This affected other family members as well. This interviewee mentioned that her **'son struggled at school in the old house and because of the quietness as well he's got time to study. He's sleeping better, so, yes, it's made a massive difference, just to schooling as well'** (SU3).

### 4.2.4 Choice & Control

The following section explores to what extent residents felt able to manage the Passive House system and how much control they thought it gave them over the internal climate of the flat. As described above, the majority of interviewees said they were comfortable operating the interface and only adjusted it infrequently or not at all. Only one resident indicated they did not feel confident enough to interact with the dials (SU7).

No, we never moved it but because we didn't understand what all these things were for. So I said to my partner, **'Don't mess with things that we don't know about. We don't know how it works some things, so just don't bother touching it'** (SU7).

Another related that he needed **'to manage the property according to how they expect me to manage it'**. This, and evidence from other interviews hinted that residents felt a degree of obligation to adhere to certain behavioral standards because of the requirements of the Passive House system. However, in general, there was no feedback to suggest residents felt the Passive House system had been imposed on them or viable alternatives had been disregarded.

## Doors and windows

The guide booklet provided by One Manchester explicitly states that *'If you're warm in the summer, you should get into the habit of opening a (secure) window in the evening to allow the house to breath and get the hot air out into the cool night air'* (page 21). Lewis (2015: 16) was more prescriptive: *'the practice of 'night purging' is often one that needs to be learned, and often occupants' natural instincts are to simply open windows whenever it is hot, rather than at night only.'*

When it came to regulating the climate, all residents actively managed this by opening windows and doors at times of their own choosing, despite acknowledging that this was contrary to guidance on maintaining the equilibrium of airflow within the system, which advised only to open in the evening. Nonetheless, residents explained that they would continue to open windows during the day, and the interviews suggest that there are two reasons for this. Firstly, they wanted to feel a natural breeze, regardless of temperature, and secondly, that there were occasions when they felt the Passive House system did not sufficiently cool the interior. In both instances, respondents made a choice to take back control over certain elements of their internal climate in line with their own daily rhythms. An additional reason to leave a window open was to enable pet cats to enter at will, in the absence of a cat flap.

Interviewees had found their own ways to moderate the temperature of the home when necessary. An example is using doors and windows to influence air flow: *'I always tend to open the bedroom window in my son's room, because he's got the hottest room in the house, half an hour before we're going to go up to bed'* (SU6).

## Frustrations and concerns

In a wider perspective, a range of comments indicated a level of frustration about personal ability to choose and control aspects of the heating. Some of these related to practical aspects of the Passive House technology itself, others concerned more general arrangements for the management of the utility setup.

These concerns could co-exist with very positive attitudes to the new system overall, but are worth exploring because they reveal a challenge relating to the boundary between areas which individual residents appeared to regard as within their own private sphere of activity and those they expected (or would allow) outside involvement in.

For example, one resident was unhappy that he no longer had a combi boiler - *'We don't even have access to the boilers now. They are locked away'* – adding that *'you haven't got any control obviously like*



Figure 3 - The development before retrofit started.



**water temperature'** (SU5). Another resident - who nevertheless had seen her bills drop - complained that they had been obliged to go with an energy supplier of One Manchester's choice:

*'We were told that. We didn't have a choice in who we picked. They just said they'll do all the paperwork and it will be cheaper'* (SU7).

It may be significant that both of these interviewees were concerned they would run up large bills stating that they preferred not to put the heating on, yet both had saved a significant amount on their bills. This may suggest that a feeling of lack of control in one area leads to anxiety about control in another (in this case, financial control). In this regard, it was interesting that the resident (SU5) who refrained from putting the heating on for fear of running up large bills mentioned this immediately after describing that he no longer had the option of a water meter, which had been installed in the old flat.

A number of other examples are explored in section 4.3, in relation to residents' perspectives on measures intended to maintain the integrity of the Passive House environment.

## 4.3 The properties - interiors and exteriors

### 4.3.1 Understanding & Communication

Across the interviews, residents talked about the ways in which they received and responded to information about their retrofitted properties. All interviewees, except one, understood that certain technical conditions were attached to living in them, and most were aware this was linked to the integrity of the Passive House system. The most common example given was the prohibition on drilling or affixing things to the main external walls, with every resident stating this message had been repeatedly re-inforced. Only one resident was under the impression that nothing could be fixed to any walls, whether internal or external.

Residents' meetings were the most common mechanism cited by interviewees for communicating with One Manchester. This forum attracted criticism from respondents, saying they had personally raised issues there, but no adequate reply (or no reply) had been received (SU5, SU6). One man recalled attending to request safety locks on the windows, relating that the response had been:

they would look into it about fitting it, and then, after mentioning it a few times at resident's meetings and things like that, it's just been forgot about. (SU5)

Another respondent stated that the residents' meetings he had attended had predominantly concentrated on issues outside of the properties:

And are these meetings more social or were people talking about their heating system and...?

They mainly concentrate on the environment. Outside... For the two times I attended they were usually concentrating on the environment... also network - you know these companies? What do you call it? Aerials. (SU2)

There was also communication between residents about various aspects. One female resident, (SU7), related how a neighbour had told her about ongoing issues with their intercom and how they had spoken to One Manchester three times without resolution.

### 4.3.2 Experience

#### Overall satisfaction

Satisfaction with the interior facilities and the decor was one of the most positive areas of the interviews. In general, there was a sense of admiration at the quality of the interior work. As residents highlighted:

I'm really pleased with the flat itself. Yes, the refurbishment's been really good..... The actual work, the standard of the work and the living in it, brilliant. (SU3)

Yes, the design also, the make-up, the space of the rooms, very big, everything was new. It has got a back garden which is very, very attractive, and at the front it's very clean and attractive as well, so there are so many things that can attract you, yes. (SU2)

Another commented:

To be fair to Eastlands (now One Manchester), we got a complete overhaul. We got kitchens, we got windows and we got a lot more than we actually thought we were going to get. We were very happy with it. (SU7)

Specific aspects of the properties could be lauded. The peace and quiet was mentioned by two interviewees as a real benefit of the triple glazing (SU5, SU6) and there was a consensus that, when small pieces of work needed carrying out, they were usually sorted very quickly.

The appearance of the flats and the blocks as a whole was highly commended. When asked if they would recommend living in this property, all those we spoke to confirmed they would, even where they had concerns about particular aspects.



If you look outside, they look brilliant. Any friends of mine who come, I get in touch and they are invited around and they come, they can't believe the change. (SU5)

They love it, they absolutely love it. It's a great talking point, the fact that they change colour. I posted a couple of pictures on my social media and everybody is amazed by the fact that... They call it the Balamory house because it changes colour! It's lovely once you're here, it's just getting to here. You just think it's a real rough and bad estate as you drive through. (SU6)

## Challenges

Conversely, some experiences had proved persistently challenging. The strength and consistency of both televisions and mobile phone signals were cited on several occasions.

If the wind is blowing, you can hardly watch Sky television. You are paying for it, but you can hardly watch it because the dish is moving about. (SU5)

Two other residents (SU1, SU2) also highlighted the quality of the satellite image as being poor, with both suggesting that the presence of a single central aerial on the roof was a causal factor.

If you want to use a mobile phone, you've got to go out and the television signal keeps going. I think that's with the cladding. (SU1)

Confusion over arrangements for window cleaning was raised by residents, who described misunderstandings over who was responsible. Significantly, communication on this subject was often described in one sided terms, not as a dialogue: "we've asked", "they're saying" or "that's what we were told".

They're saying it's twice a year that Eastlands (One Manchester) will pay and we're not allowed our own window cleaners because of what the building's made of... He has been told to go, which he has, but Eastlands (One Manchester) again, we're waiting for them to come back to us with a better [solution]...

### 4.3.3 Choice and Control

To a large extent, interviewees felt they had been given substantial choice over the interior, particularly with regard to the décor. The fact that they had been given such options was viewed very positively.

I was delighted. It's lovely, yes. We chose our own decoration. Well, I got the paint for the hall, whatever colours we wanted, if we wanted colours, and they did it. I was delighted when we moved in. (SU1)

The same resident highlighted the offer of a shower or bath when they moved back in as welcome option as they had previously struggled to get into a bath. Another commented:

Oh yes, the fixtures and fittings, yes; all the way along. We picked the laminate; they asked us what carpets we'd like, what paper, yes. (SU7)

This was enhanced when, on the odd occasion that wrong materials had been ordered, they had been quickly replaced. In the main, the restriction on attaching things to outside walls was accepted, but the language used to describe some of the other constraints implied that residents felt this was unduly intrusive ('we're not allowed'; 'they have banned that'). The lack of choice about certain features of the property were a source of frustration. This included the lack of an individual letterbox.

...just things that we simply expected to be able to do when we came back like silly things like (cleaning) the windows, have our parcels delivered. (SU7)

We knew we couldn't have a letterbox, so they weren't very pleased. The residents weren't very pleased about that. (SU1)

## Tensions

These quotes reveal the element of expectation among those who had been decanted based on what they had been able to do at their past property. For three interviewees, (SU6, SU7, SU9), the inability to clean their own windows (or hire a window cleaner) was a major property related grievance. More than one (SU6, SU9) had arranged a window cleaner of their own but went on to say they had been required to stop by One Manchester and were awaiting more information on future arrangements. In the perception of both of these interviewees, it was perfectly possible for a professional window cleaner to avoid damaging the external cladding and they felt frustrated in their attempt to take personal control of this element of their property. Again the choice of phrase was interesting:

we're not allowed our own window cleaners because of what the building's made of, but as a woman there's no way I'm putting up with just twice a year cleaning of windows. (SU6)

The resident who had contacted One Manchester about window locks regarded their installation as a way of dealing with the occasions when the interior became too hot, as he could simply lock them open as required. However, without such locks he felt unable to open them in case he forgot to close them when leaving the property or going to another room leaving his property insecure. As a result, he left his back door open which he deemed less likely to overlook.

Similarly, the desire to have a greater degree of independent control over the choice of television and satellite providers was raised by a number of residents. Although we note the guidance on pages 15 and 16 of the resident's booklet "Getting Connected in your home", which details options such as cable and Eutel for international channels, as well as advice on multi-room

operations, it was not within the scope of the study to check the precise details of the set-up, what channels were available or what devices individuals had installed.

Nevertheless there was a perception that constraints existed. For one resident this was particularly crucial – **‘the most important thing’** – as satellite TV enabled them to maintain links to a wider cultural and linguistic base. Effusively complementary about the development in all other respects, the interviewee was disappointed they couldn’t install a satellite dish to pick up particular overseas channels pointing out that **‘a communal antenna is only English channels... but what we want is our native channels’**. Accessing the channels had been unsuccessful as the stream had proved too intermittent. Linked to this issue was the criticism (made separately by two other residents) that they couldn’t operate multi-room channel systems effectively as they believed they had been promised.

## 4.4 External environment including gardens and common spaces

### 4.4.1 Understanding & Communication

Discussion about the gardens and other common spaces constituted a significant portion of the dialogue. This may reflect the real importance of the subject to some of the residents. Interestingly, when asked if they had made any queries about the Passive House development at an information day organized by One Manchester, one long term resident commented:

‘Not really, we were asking about the gardens and that.’ (SU1)

Limited or confusing communication tended to be the main cause of dissatisfaction regarding the external environment. Several interviewees stated that there were ongoing problems with maintenance of the new gardens, exacerbated by a lack of clarity about what level of management would occur. As one commented:

They don't tell you. I must have asked him a dozen - not only me, nearly everybody has asked them - and the answer was, we're having a meeting and you'll be notified by... letter. I said to him, 'I take it you're telling us by letter that you're not going to cut the grass.' 'Oh, it's not that way at all!' The letter hasn't come and they had the meeting three weeks ago; so I don't expect them to cut it. (SU6)

This resident was under the impression that the delays they had reported were down to funding issues: **‘They said something about the money, or no money or something like that’**. This was echoed by two other residents who also suggested the lack of maintenance had occurred because there was limited funding available (SU7, SU9). Others spoke about problematic communications over security gates, rear fencing, extra recycling and CCTV. The veracity of such claims is not under review here, but there was a clear perception

that lack of money was at the root of a number of the outstanding issues. Just as important was the view that communication on this and other aspects of the external environment had not been clear.

### 4.4.2 Experience

Overall, residents were extremely positive about the external areas. The closure of Erneley Close as a through road had made a **‘massive difference’** making it much quieter. The same resident described the central landscaping as having had a brilliant impact, with people feeling safer.

#### What's your opinion on the work that was done outside?

Absolutely stunning. You had to see it before. It was horrendous. It was just a green mound and we had lots of unsociable people in the bungalows and they were leaving their beer cans and everything else that goes with it. Now, oh, that's got to be the best part. If you'd go out there, we were all neighbours but you simply didn't want to go on the green with fags and whatever. Now, as a community, we use the benches. We all sit there and that's what's made a nice community. That's what's made us be able to get together, just that little bit of garden. (SU7)

For those who had been decanted the new gardens were perceived to be better, not least because they offered far more privacy than those in the previous incarnation. The appreciation was evident in the number who spoke about the attractive aspect of the close in comparison to neighbouring residential areas and the pride expressed in the number of people who came to take photos or made envious comments. Satisfaction was best conveyed by the responses of family and friends invited around, such as this example making a direct comparison with former conditions:

I wouldn't dare let them outside but now we go in the lovely garden and we can play and that garden is used so much and we all look after it. If we see someone in it, 'Don't be climbing on that wall,' and, 'Don't be pulling that tree,' because we're proud of it now. That's our garden. That's ours! (SU7)

Nevertheless, several respondents in one of the two blocks expressed concern that their lawns appeared to be in an increasingly poor condition.

### 4.4.3 Choice & Control

As with certain physical aspects of the internal environments, there was a clear sense the prohibition in these areas was an intrusion into what had formerly been residents’ own business. One remarked that, as the grass was not being cut, he had gone out and bought a mower **‘because I’ve always cut my own grass’**, but cancelled the purchase after being told One Manchester would cut it.

Concerns were raised about restrictions on planting. One interviewee stated *‘they just say it’s ours but they don’t allow us to do anything we want’* (SU2), citing the ban on growing vegetables. Other residents commented similarly that they regretted not having a flower border, or that they had wanted a particular species of tree. Stating that they had been told they couldn’t plant, one added *‘I quite like gardening. So that was a bit disappointing’* (SU3).

One man felt unhappy that he had been unable to bring his pets back, which he attributed to the fact One Manchester wanted to keep the gardens nice. The boundary of personal choice and intervention was perfectly encapsulated by the description of one resident who talked about the planting arrangements:

We were told we had to have the trees, and the reason for that, which I understand, is to obviously soak up the water but it’s right smack bang in the middle and they didn’t ask whether or not we were having sheds, so we could work around the shed. I think it’s just asking us rather than telling us, ‘Well, you’ve got to have this for this reason’. (SU6)

## 4.5 The decanting process

### 4.5.1 Understanding & Communication: the development

Of the nine residents we spoke to, five had lived in Erneley Close prior to its renovation, and had experienced the ‘decanting’ process, whereby they had been temporarily relocated to other properties nearby.

#### Before the Move

The interviews provided evidence that regular communication had taken place during the initial period before relocation, but it is worth noting that the passage of time meant there was some uncertainty about the nature and the timing of different communications. More than one recalled a series of initial consultation meetings: confirming for example that ‘We had a say about what was going on and they told us what was going on’ (SU9), while another commented: *‘They did come and speak to us ... They did ask our opinions’* (SU7). Another remembered that they had been offered alternatives if they did not like the first option offered to them.

While initial works were occurring, updates continued for residents remaining in their properties:



Figure 4 - View of tenants’ gardens



We had a tenant liaison officer from Casey's. He was really good. So he was always on hand either by phone or in person. So as and when things came up, you could approach him and he was very good at keeping us in the loop, kind of thing, as things were moving on. (SU3)

When asked to explain their understanding of why relocation had subsequently become necessary, most had a general awareness that after the work had started, unforeseen major structural problems had emerged that required significant physical alterations. All stated that they had not initially expected to have to move out.

Interviewees remarked on the uncertainty regarding the duration of the decanting. An example of the problems this generated was provided by one resident who had put many of their possessions in storage, believing the relocation would be for only a short period, and then found that they had to manage without them for longer than expected.

### After the move

While consultation and communication appeared to have been good up to the point of decanting, and good after the return, the experience was less satisfactory while

people were away. Some felt that communication had been one sided, and that they had repeatedly asked for information without receiving any adequate response. Related to this, three interviewees talked about regularly visiting the site to ask about progress, but were unable to get a definite answer:

I just said, 'Look, I come down every day with the dogs. Just, can you tell us?' 'No, we can't tell you anything. We can't tell you anything.' It's been nothing. I'm asking on behalf of everybody: full stop, nothing. Then I did speak to Eastlands [now One Manchester] and they said, 'Well, there was a lot of problems with subsidence, blah-di-blah,' and I just said, 'Look, you could have told us that. You could have let someone know. I would have told people'. (SU7)

It is not clear who they were speaking to on such occasions. If these were random contacts with on-site workers, it may explain the lack of clear response. It is notable this person indicated they spoke to One Manchester after the site visit and received a full update.

One other long term resident commented that it was hard to know what was going on in their property because *'they wouldn't let us in'* (SU9). It may be significant in this regard that another decanted interviewee (SU5) mentioned in passing that he had



Figure 5 - The front of the development.

maintained regular communication with a liaison officer from the contractor (probably the same person referred to by SU3 above) until the latter had left for another site when residents moved back in. This same resident noted he rarely saw the liaison officer from One Manchester on his return, attributing it to the multiple sites they were responsible for covering. This was contradicted by others (SU3, SU9) however, who cited examples of immediate contact: *'The day we moved back in, [name of officer] came round and said this was how you work that and that's how you work this, that and the other'*. (SU9)

It does however suggest that one possible element of dissatisfaction was not the content of messages, but the delay in receiving information. It is not within the remit of this study to identify the reasons behind this, although the same complaint is also observed in later communications about gardens and window cleaning, whereby residents stated that they would prefer to know one way or the other rather than remaining uncertain for extended periods.

#### 4.5.2 Experience

##### Being away from home

Interviewees identified some negative aspects in relation to being relocated, which is perhaps unsurprising given the extended upheaval implicit in such an operation, compounded by the apparent uncertainty over when they would return. This appeared to be more pronounced for those with health problems. One woman described the flat she was allocated as *'lovely'*, but added: *'I was three floors up and I've got a bad knee, and I didn't like where I was'* (SU1). This was a similar experience to another resident with a long-term condition whose temporary flat was up a long staircase. Another described a detrimental effect to their mental health from both the condition of the property and the area they were relocated to, such that they felt it necessary to seek medical help. On the other hand, other tenants had been quite content with their temporary property. It was the process of adjusting to a dramatically different residence on their return that took some time.

One effect of moving was that it often removed people from the amenities they had habitually accessed, such as shops or medical support facilities. This was problematic when it came to visiting doctor's surgeries and pharmacies – two interviewees specifically referred to this, but it also affected travel to visit friends, as well as requiring the redirection of post, etc.

One very positive comment related to the assistance One Manchester had given to a tenant reimbursing the difference when water bills at their temporary home proved much higher than previous payments (SU9).

##### Coming home

The experience of returning to Erneley Close after being away was also described. All spoke about returning while building work was continuing. The three residents beyond retirement age all mentioned feeling at risk from accidents involving building materials, as well as remarking on the noise, dust and general disruption: *'coming back to a place that looks like a building site day in, day out, isn't good for your mental wellbeing'* (SU5).

Several said there had only been minor 'niggles' inside the actual new properties which had been sorted quickly. One man raised an issue with the way the contents of his garden were dealt with while he was away – a problem for which he was later compensated by One Manchester:

I asked a few times, could I come in and move my plants? - because I love my garden - but they said that we'd be only gone for eight weeks and it would be safer... But when we came back everything was gone, broken - just dumped in the truck and away it went! (SU9)

#### 4.6 Discussion

The exceptional nature of the Erneley Close scheme means there is very little written from a that is directly comparable, i.e. a qualitative perspective on residents' experiences of participating in a Passive House retrofit. The views of individual residents were often nuanced, with praise and criticism selectively applied. As such, the findings from this study are an important insight into individuals' motivations and attitudes because they provide fine-grained detail as to the reasons why. It is hoped that this will aid a more sophisticated approach to understanding how residents respond to different aspects of this type of retrofit and how existing engagement may be tweaked and improved.

There is, however, a growing literature concerning the process and outcomes of retrofit. This has generally indicated that there are many positive outcomes associated with energy-efficient retrofit, including cost-savings, health, and the use of space in homes. However, it also highlights the often difficult and disruptive nature of the impacts upon tenant's lives and the need to address unexpected details in the period following implementation and to help them adapt to and adopt new technologies and practices (Sherriff et al 2015; Sherriff and Martin, 2016; Brown, Swan and Chahal, 2014).

Clearly, the residents of Erneley Close are unlikely to face such upheavals again. Nevertheless, the evidence gathered is of importance should One Manchester consider future large scale development, both in terms of preparation, dealing with unexpected challenges, but also in choosing the particular operating arrangements for highly centralized systems like Passive House. These may be applicable in a whole series of other scenarios, such as waste management and transport provision.



There is also learning which can be applied when engaging new residents as and when they arrive and settle in. Writing with regard to supporting older residents in Passive House developments, Lewis commented that occupants' ability to adapt and learn *'is partly dependent on their willingness to do so'* (2015:21). Based on One Manchester's Erneley Close renovation, Lewis's guide made a series of recommendations around how housing providers could engage optimally with residents when they first move in and further down the line. Some of the findings chime with our research – for example written guidance is generally useful, and often people hadn't taken in the information on the heating system when they were first told about it. However, the detail collected in this study allows us to add greater nuance to the picture provided in the guide.

For example, Lewis stressed the importance of feedback to residents on how much energy they were using and how enabling people to compare their usage with their neighbours aided a general fall in consumption. We were able to add to this picture - while residents confirmed they themselves were saving money, there were perceptions that others weren't. One had, for example, seen a dramatic reduction in expenditure yet said they didn't put the heating on for fear of racking up large bills.

A range of attitudes, opinions and knowledge were observed across the nine interviews. Consensus was most obvious in three areas: the visual appeal of the

properties (inside and out); the reduction in energy bills and the willingness to recommend the development. Two residents (SU2, SU4) independently endorsed it '100%'. All those who had been 'decanted' regarded the renovated properties as huge improvement on what had been before. Nearly all were positive about the indoor climate, even if they had some issues with aspects of the system.

There was a clear sense that elements of Passive House were perceived as infringing on what would normally be considered their own space of personal control. This did not primarily relate to the technology itself but to the indirect effects of ensuring the integrity of the building fabric (both interior and exterior) remained undamaged. It applied not so much to prohibitions on affixing items to external walls, but to ongoing issues with the mobile phone signal and constraints on satellite provider. The same thread emerges in other areas such as the constraints over what could be grown in gardens, lack of letterboxes and window cleaning. This was demonstrated best by the language adopted by nearly all residents to describe the behavioural expectations in phrases such as 'we've been told we can't' and 'we're not allowed'.

Some of these constraints relate to maintaining cultural links or individual self-esteem and well-being. It is important One Manchester recognise such factors, if only for future planning to look into the potential options to accommodate such issues. The diversity of the



Figure 6 - The development from the rear

tenant demographic is important, and the freedom to make choices over use of private garden space, satellite channels or play spaces will probably surface again. For others the personal value whether in terms of planting, storage or BBQ was important to their sense of self.

In general, it was in the communication between residents on the one hand and One Manchester on the other where the most significant dissatisfaction lay, and this predominantly focused on more recent periods of time. The prominent issues with cutting the grass and cleaning the windows appeared to have arisen relatively lately: ***'This year they've just stopped. They said something about the money, or no money or something like that'*** (SU9). While some suggested that liaison officers had less time than previously or had an increased workload, there was plenty of evidence that face to face contact was regular and had been thorough throughout the process. It was not always the personnel or even the issue itself that was the problem, but what they had been told (or not told) and the ways in which that caused dissatisfaction.

One Manchester confirmed that a number of these post construction issues occurred due to the restructuring of the organisation and resulting staff changes. For example, the absence of a designated housing officer meant other departments had been required to liaise with residents. This may explain the communication problems and the apparent decline in contact noted by residents

as the renovation came to an end. It would be essential that if future projects of a similar nature were undertaken risk assessments take account of the potential for unforeseen staff shortages and developed suitable contingency plans. In this regard, the current forms of communication appear to be underperforming, leading to a risk of progressive dis-engagement. All respondents were aware of the existence of a residents group. Several residents commented that they did not attend because of work and/or family constraints. However, those that did stressed they had taken the opportunity to voice issues, but did not feel they were adequately taken on board.

Views on alternatives such the helpline were mixed, with some praising it, and others critical. In general, individuals cited face to face contact as their main route to find out more. No one mentioned online sources or newsletters as a source of information. There was clearly frustration for some that clear answers were not forthcoming.

One impact of this perceived difficulties in providing clear answers could be seen in the comments made by several interviewees speculating on what they were paying their service charge for. This should be seen in the context of Lewis's emphasis on 'trust' between landlord and tenant, which he specifically linked to provision of information – 'Loss of trust can cause tenants to turn to other, possibly less reliable, sources of advice such as friends, family and neighbours'.



Figure 7 - The during the retrofit

In the absence of a clear lead from One Manchester, there is a risk that either incorrect or misleading information is circulated, or that pessimistic or cynical interpretations take hold. The importance of peer-to-peer communication among residents should not be underestimated, both for positive and negative impact.

What is also clear is that there is a disparity in understanding among the residents about Passive House, with some evidence that older people (who constitute a large proportion of the residents) are at more risk of not understanding both the operation and the benefits, as per Lewis. This may relate to perceptions that it is too 'high tech' to understand, but certain references to neighbours indicate poor hearing among some residents may be another factor inhibiting the uptake of information (although we did not observe this directly).

However, this was not a universal rule – often an individual's background and gender appeared as important as their age, with men expressing much greater confidence. It is not within our remit to propose remedies to any of these challenges, although targeted

work with those most likely to struggle with the system may be beneficial. This should happen in parallel with work to challenge perceptions that other residents are spending much more or that a central provider will be more costly.

Notwithstanding these challenges and resident concerns, there are some major positives. No one said the system was difficult to use. The health benefits cited by a majority of interviewees was striking, particularly the impact of the indoor climate on asthma sufferers. This ought to be publicized widely.

Overall interviewees were very happy with their flat and no one expressed a desire to move. Rather they advised friends to relocate to Erneley Close. The role of the cosmetic appearance should not be undervalued – while Lewis (2015: 21) suggested people may be initially attracted by a newly built home, it was clear that two years after renovation, residents were still enjoying the interior and exterior greatly. There was recognition that a great deal of engagement had been done and One Manchester had often 'gone the extra mile'.



# 5. Findings: Monitoring



In this chapter, charts are deployed to visualise and understand comfort in the seven monitored properties. An analysis of the conditions within the lounge area was carried out, according to the British Standard 15251 method (British Standards, 2007). This method provides a temperature range within which it is likely that the occupants are comfortable, based on a large pre-existing body of observations.

This method is referred to as “adaptive thermal comfort” as the comfort “zone” shifts when a rolling average of the external temperature increases past a certain point. It is observed, for example, that during periods of sustained warm or hot weather, people adapt to the heat by changing their behaviour or clothing. The range of temperatures within which they feel comfortable shifts upwards, so that temperatures that were uncomfortably warm during cooler periods of the year become more comfortable. Conversely, cooler temperatures that were comfortable when the occupants were adapted to them in cooler times of the year will become uncomfortably cool when the occupants have adapted to sustained periods of warm weather.

## 5.1 Lounge temperatures

Figure 1 is an example of the temperature data from the lounge of Flat A, overlaid on the comfort zones. Note that the comfort zones shift upwards during periods of sustained warm weather.

Figure 2 summarises temperature data for all 7 properties, with the outside temperature for comparison. Lounge temperatures for all of the monitored flats have been graphed for the whole of the monitoring period, along with the external temperature for the same period. We can see that the temperatures within the flats remain relatively stable and similar to each other throughout the year, and are relatively independent of external temperature. There is some slight increase of internal temperatures during the hottest summer period, but the increase does not reach dangerous levels. Overall, the data supports the argument that the internal conditions of the flats are tightly controlled within reasonable comfort limits.

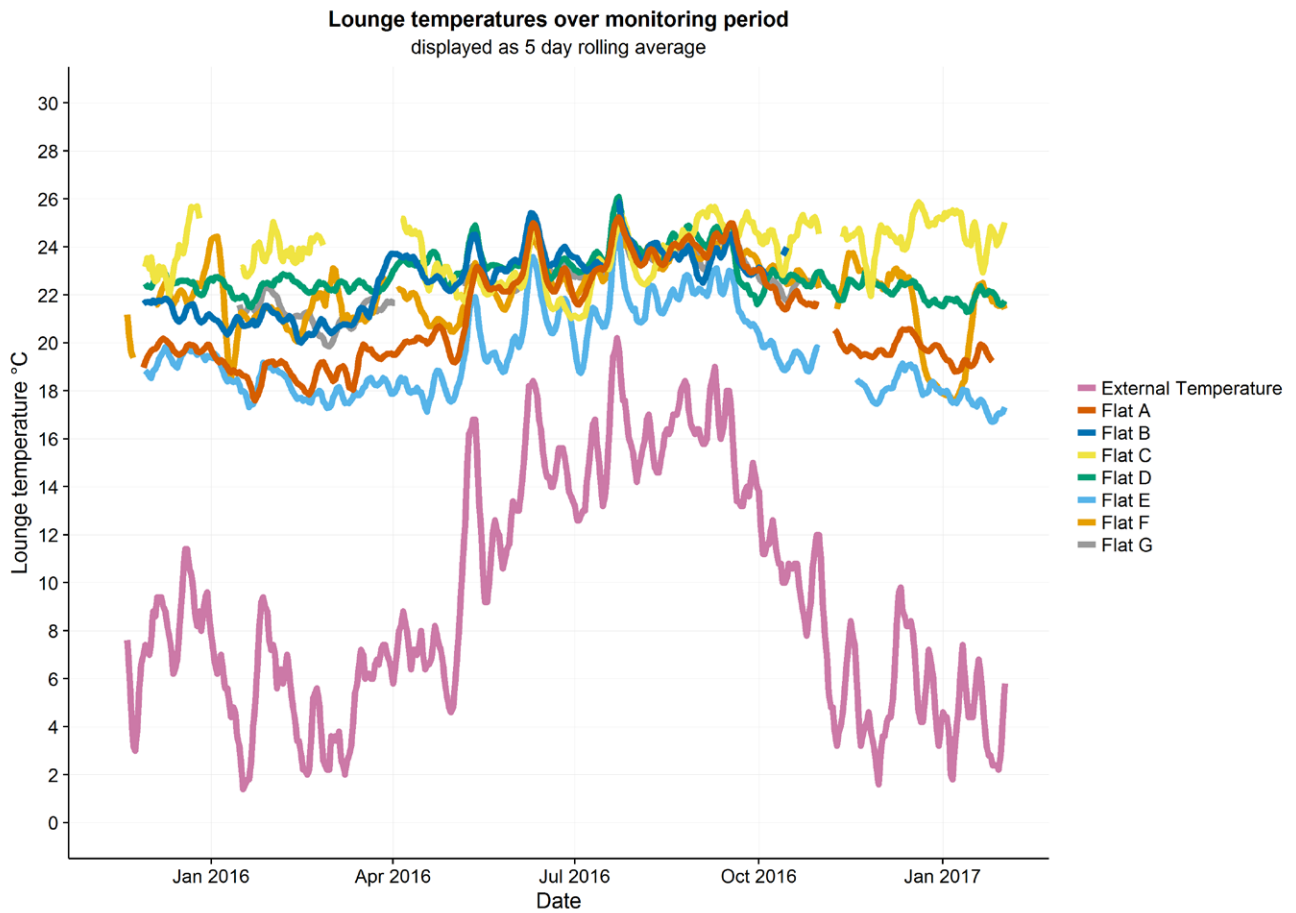


Figure 8 - Lounge Temperature with adaptive thermal comfort zones, Flat A

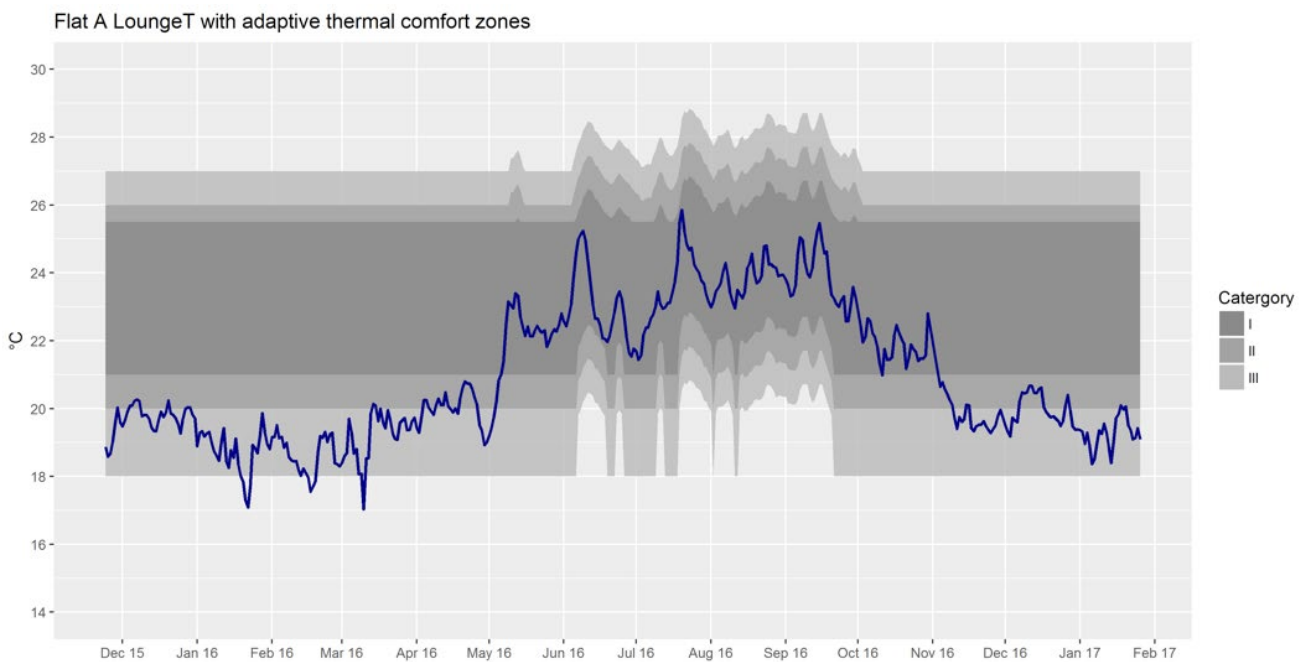


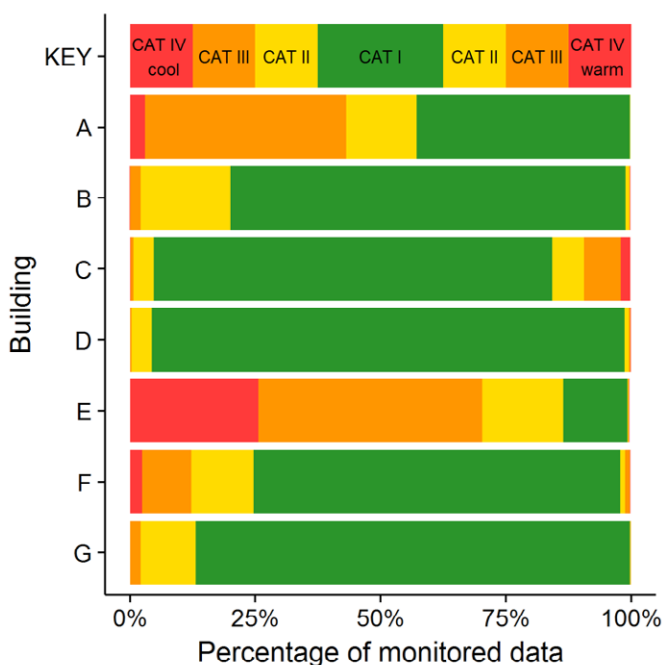
Figure 9 - Lounge temperatures over the monitoring period, 5 day rolling average

## 5.2 Comfort

The accepted method of assessing comfort, British Standard 15251, splits the assumed comfort temperatures into three categories relating to levels of expectation and special requirements of the occupants, with an additional category (IV) for values outside of these criteria (Table 2):

**Table 2 - Categories of comfort, Source: British Standards (2007:13)**

Category	Explanation
I	High level of expectation and is recommended for spaces occupied by very sensitive and fragile persons with special requirements like disabled, sick, very young children, and elderly persons
II	Normal level of expectation and should be used for new buildings and renovations
III	An acceptable, moderate level of expectation and may be used for existing buildings
IV	Values outside the criteria for the above categories. This category should only be accepted for a limited part of the year.



**Figure 10 - Percentage of monitored data falling within comfort zones**

Figure 3 compares all 7 flats in the sample, showing the proportion of the monitored data that falls within each of the categories, with the categories corresponding to those in Table 2. For example, in Flat G approximately 90% of the monitored data falls within CAT1: this implies that comfort levels in the property fall within CAT1 for 90% of the monitored period.

The red category 4 (CAT IV) bar segments to the left of the centre show the proportion of readings that are too cool for comfort, similarly the red CAT IV segments on the right show the proportion of readings outside the comfort zone at the warmer end.

Figure 3 is useful in providing an overview of comfort levels in the seven properties. We can see, for example, that for the majority of the monitoring period, the temperature in most of the monitored flats remained within categories CAT I to CAT III, suggesting a high level of thermal control and comfortable occupants. While Flat E appears poorly performing when compared to the rest of the sample, the temperatures remain within at least CAT III for 75% of the monitoring period. CAT III is defined as “An acceptable, moderate level of expectation and may be used for existing buildings” (British Standards). The lower temperatures relative to the rest of the sample could be the result of a number of variables, including personal temperature preference, a preference for natural ventilation, and periods of no occupancy. It could also be the result of the performance of heating/cooling plant/controls or building fabric.

## 5.3 Relative Humidity

Figures 4 to 10 comprise psychrometric charts. These present temperature on the x axis and absolute humidity on the y axis. Factors like occupant comfort and condensation risk depend on relative humidity rather than absolute humidity, and this is represented on the graph as a series of curved lines. The lines are curved because relative humidity is affected in a non-linear way by both air temperature and absolute humidity.

The red box in each of these charts represents a “comfort zone”, the boundaries of the conditions within which it is assumed that the occupant will feel most comfortable. The boundaries used are between 20-26 oC and 25-60% relative humidity, classed as Category II in the standard BS EN 15251 and as described in Table 2. Please note that these are assumptions taken from a standard and not from the occupant themselves; conditions of comfort can vary significantly from person to person, and it is quite possible that the occupants would report being comfortable at the times when the readings fall outside the assumed “comfort zone”.

The readings are represented as a density graph. Each individual data-point on the graph is a reading of temperature and humidity over a period of 5 minutes.

Their position on the graph is determined by their temperature and humidity, and their colour is determined by the proportion of readings over the year that fall at that combination of temperature and humidity. The chart legend shows the colour scale in relation to the number of readings taken, and the colour can be taken as a proxy for the proportion of the monitored period at which the temperature-humidity combination is at a particular point on the chart. The areas of the graph with a red colour indicate a high number of readings with similar temperatures and humidity – that is, a large proportion of the monitored period – and the blue areas represent low numbers of readings, or a smaller proportion of the monitored period.

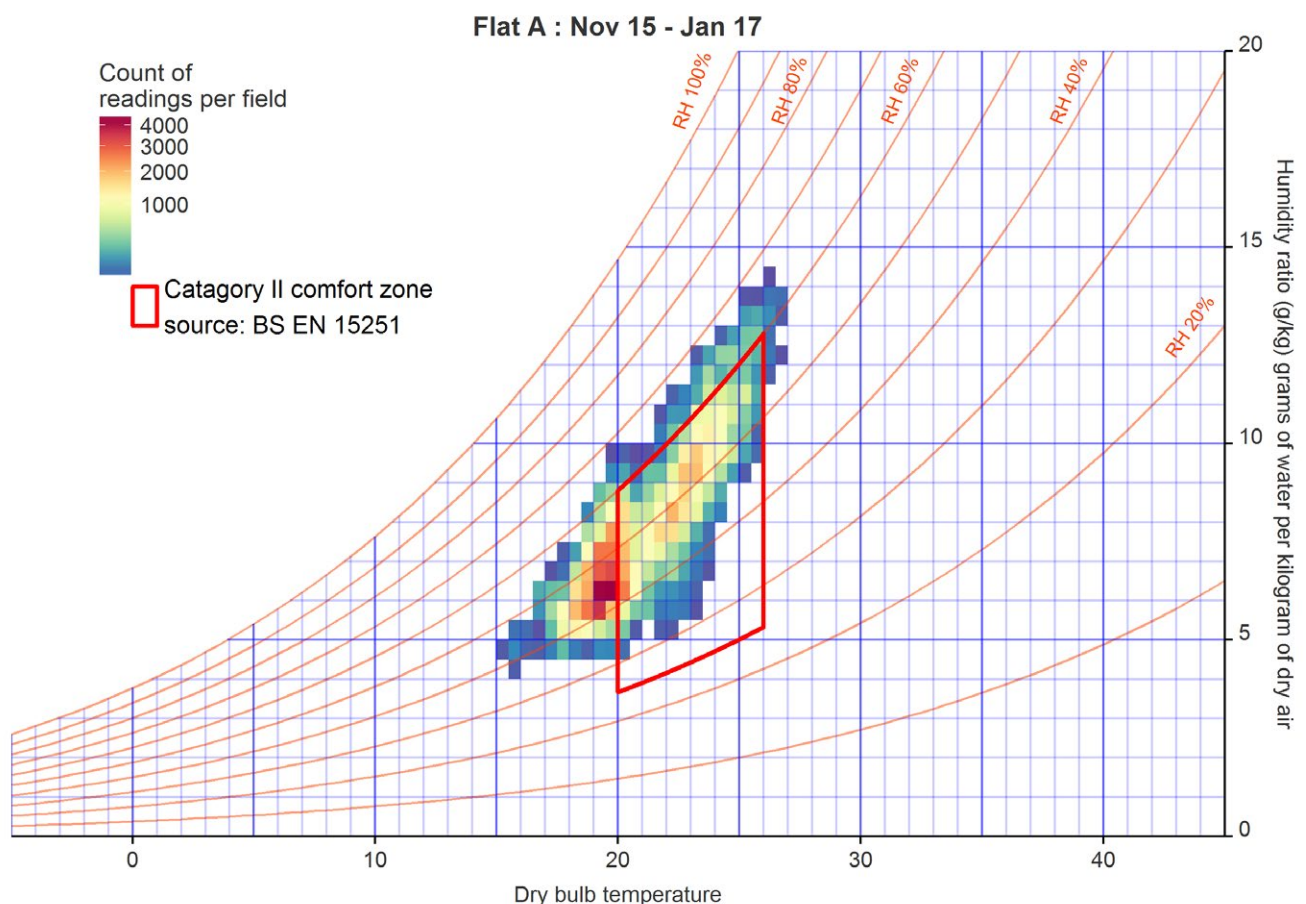
If the data were to be graphed as a series of individual points it would be very hard to interpret as there are thousands of readings; therefore a two-dimensional histogram or density graph has been used. Note that, the colour scale is logarithmic, to show greater detail at the lower end of the scale.

The charts help us to understand the likely levels of comfort in the properties, whilst it is important to note, as above, that actual report comfort is likely to vary from person to person. There is some variation between graphs, but all the flats show their highest concentration of readings either inside or near the borders of the comfort zone, which indicates that the properties are

likely to be comfortable for the majority of the monitored period. The spread of the readings is very narrow, possibly indicating that the conditions in the lounge are highly controlled.

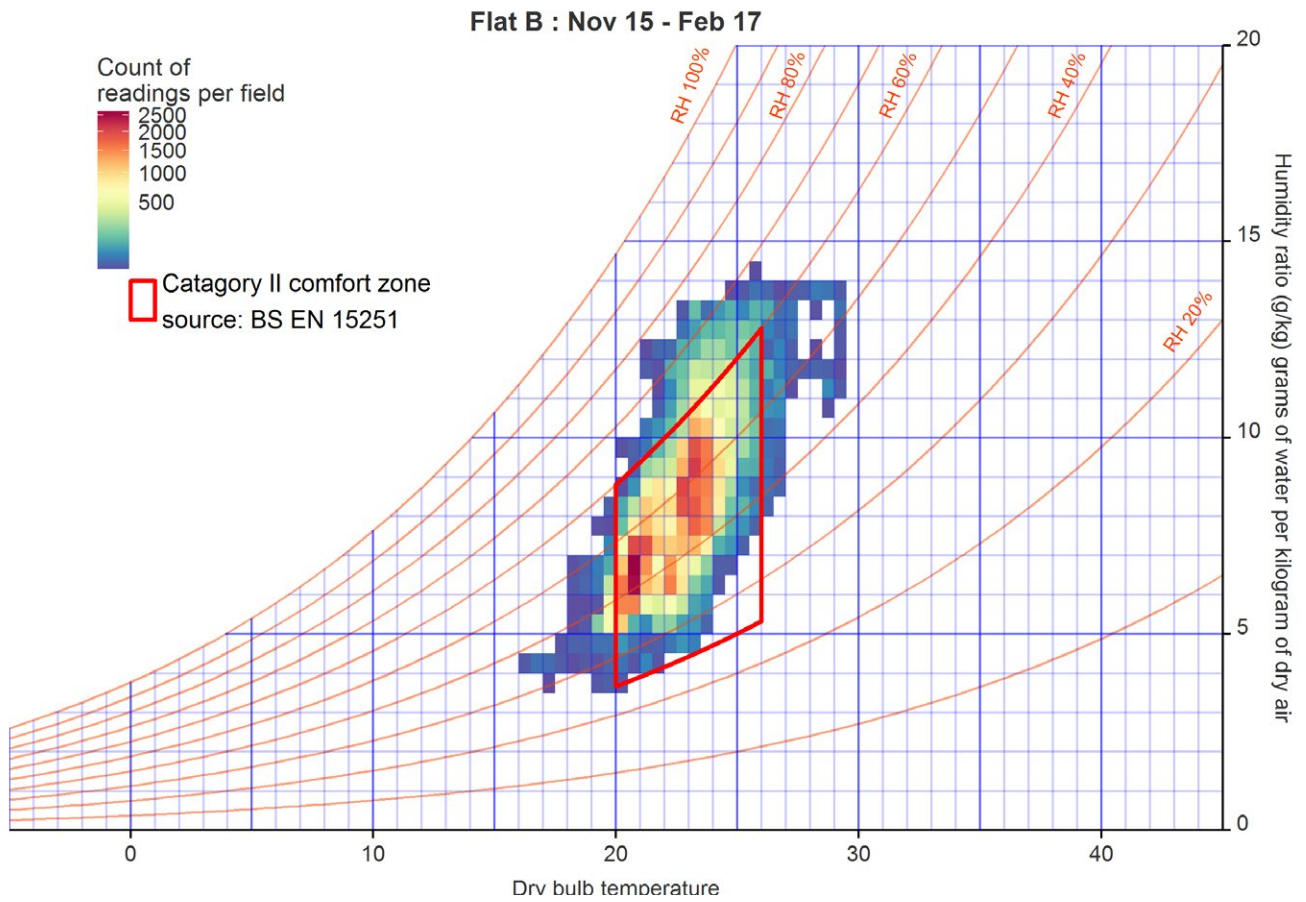
## 5.4 Summary

In summary, the monitoring carried out as part of this research suggests that the monitored properties are highly controllable and very comfortable. Whilst there is some variation, as shown in Figures 2 and 3 in particular, this is within an acceptance range and many of the flats evidence a high level of comfort across the majority of the monitored period.

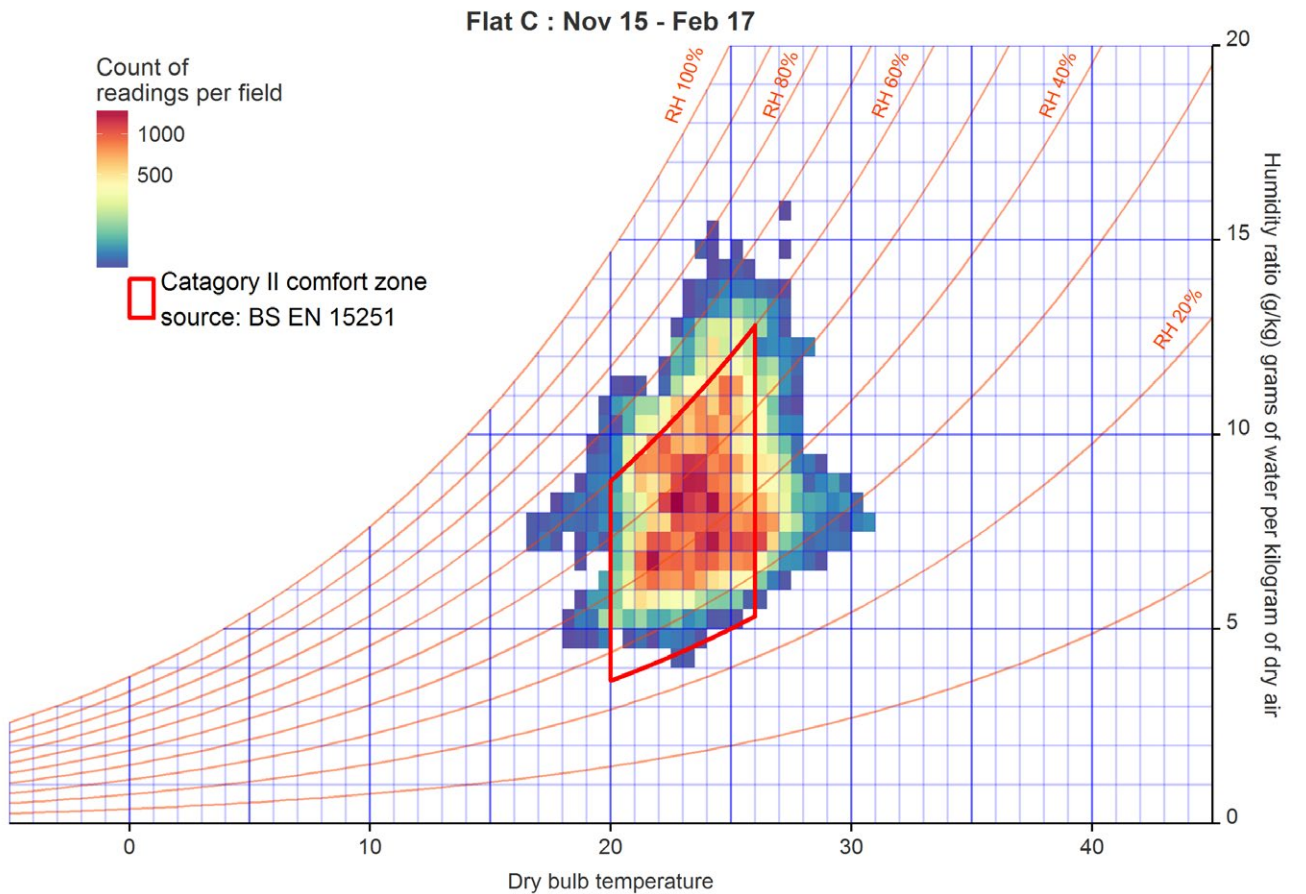


**Figure 11 - Psychrometric chart for monitored period, Flat A**

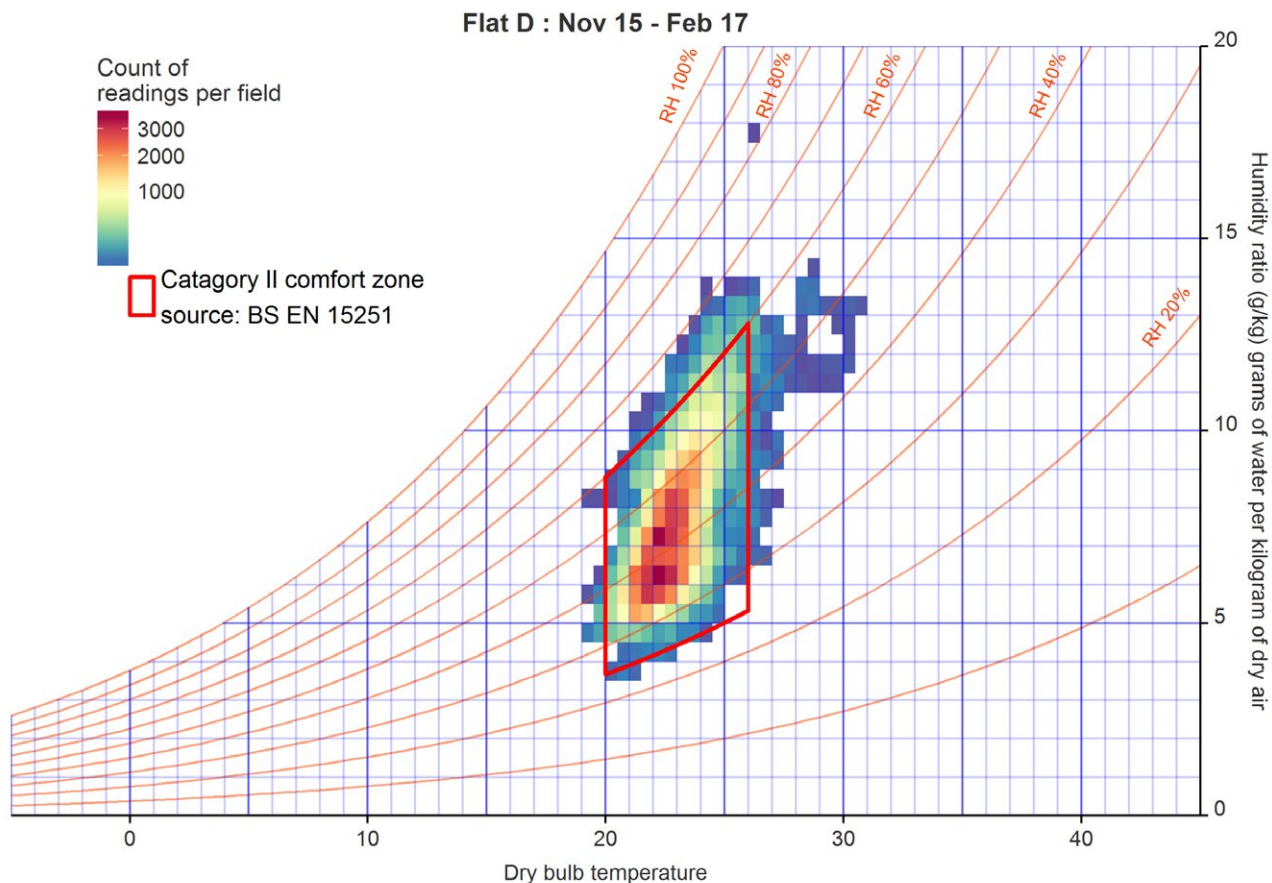




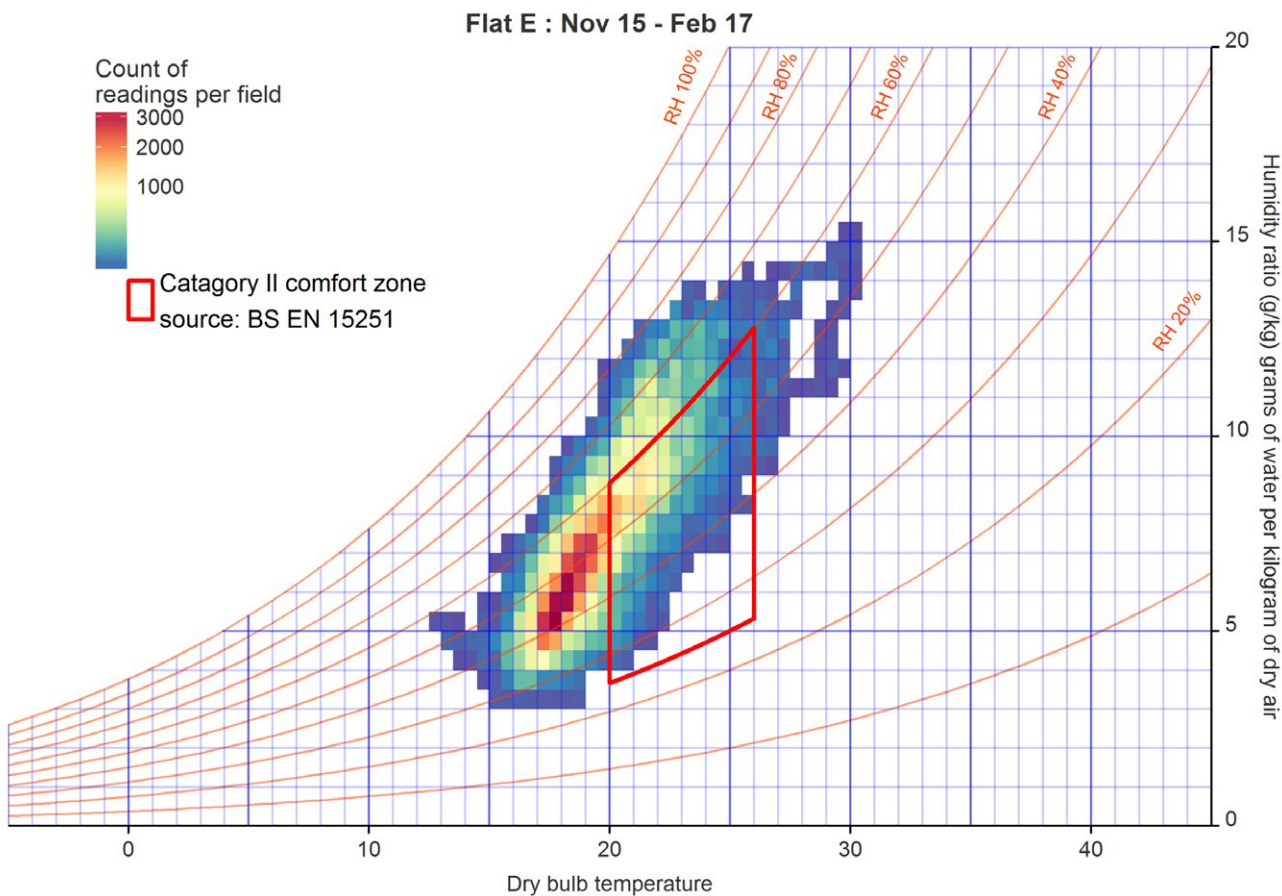
**Figure 12 - Psychrometric chart for monitored period, Flat B**



**Figure 13 - Psychrometric chart for monitored period, Flat C**

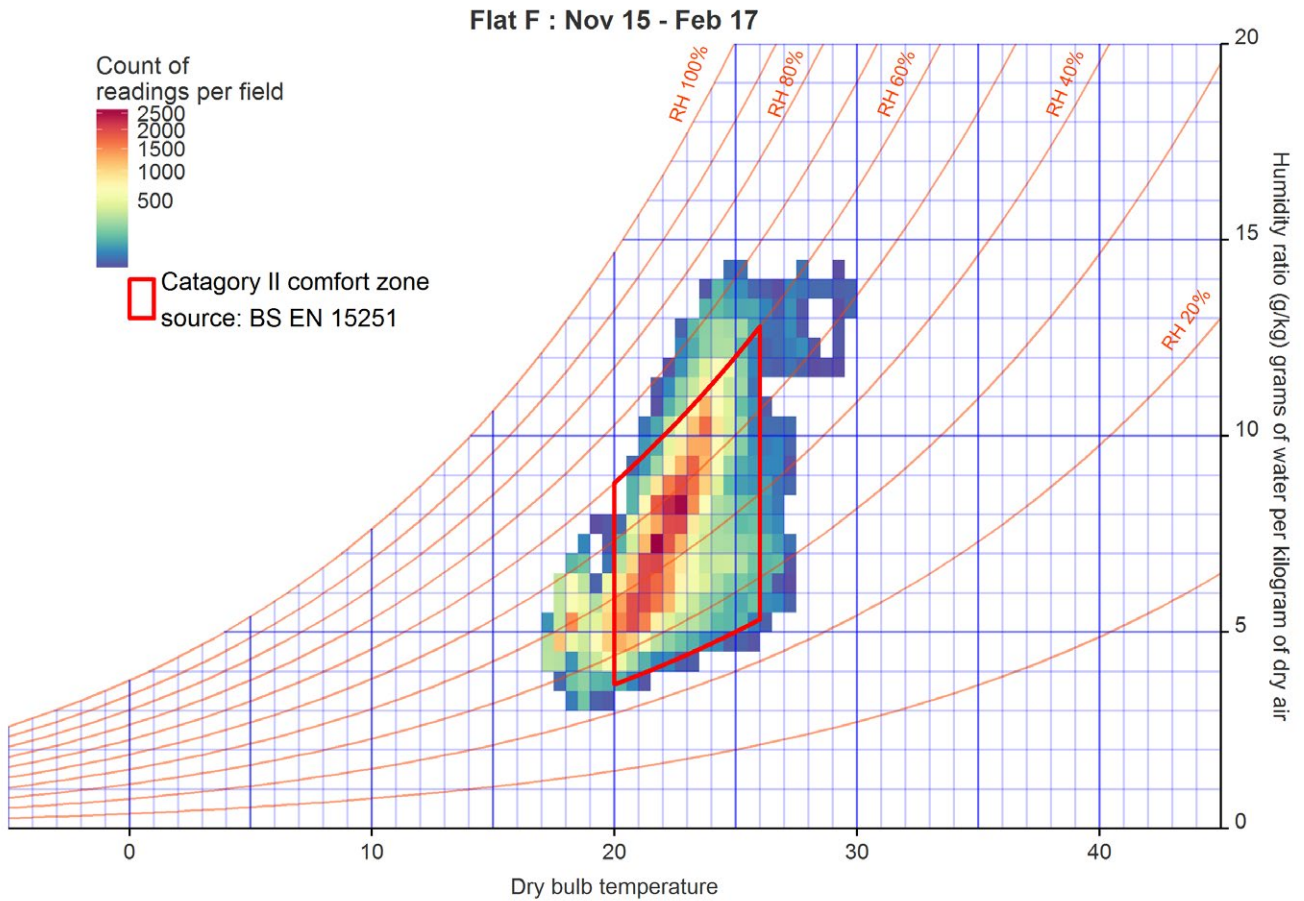


**Figure 14 - Psychrometric chart for monitored period, Flat D**

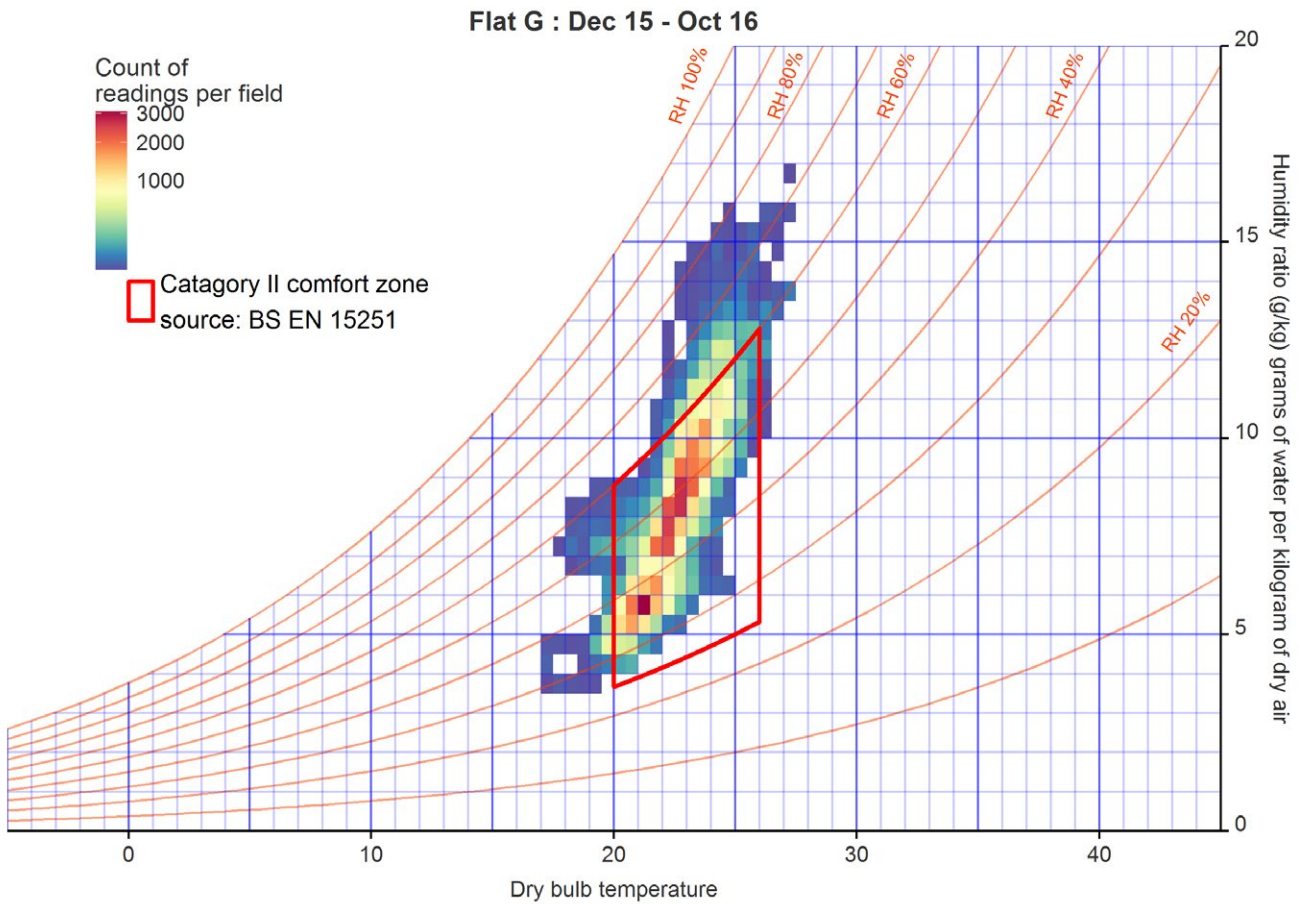


**Figure 15 - Psychrometric chart for monitored period, Flat E**



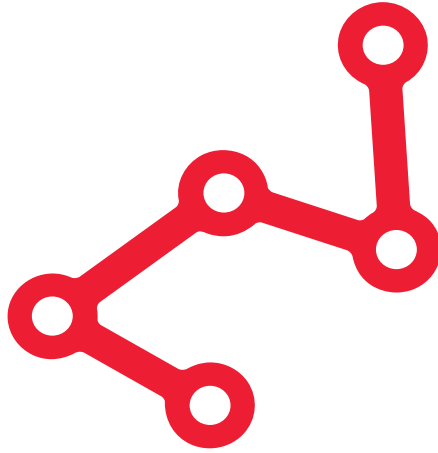


**Figure 16 - Psychrometric chart for monitored period, Flat F**



**Figure 17 - Psychrometric chart for monitored period, Flat G**

# 6. Recommendations



## 6.1 Introduction

Following the overview of the findings presented in Chapters 4 and 5, the following forms a set of recommendations informed by the analysis.

As a note, the authors recognise that as the research was a snapshot in time, some of the issues may have causes specific to the resources available to One Manchester at a particular time, and that this may change, now or in the future. While it is not within our remit to define precise remedies to any of the challenges noted in this report, the data does suggest there are some short, medium and long-term issues that would benefit from attention.

The research has combined qualitative research involving discussing experiences directly with tenants and quantitative research entailing measurements in a subset of the flats. Whilst some concerns are raised by the tenants and should be carefully considered by One Manchester and other housing providers considering this approach, the interviews evidence broad satisfaction with the dwellings following the retrofit. The quantitative results are compatible with these observations and show that the temperature and humidity in the flats suggest a high level of thermal comfort.

## 6.2 Recommendations

### **One Manchester should provide open and clear updates to residents.**

Our analysis suggests that clarity is needed over timetabling and responsibility for certain ongoing maintenance, such as window cleaning and aspects of garden upkeep. Residents expressed concern that these services appeared to be delayed and felt that they had not been given a clear explanation.

### **One Manchester should investigate and, where possible, pursue ways to address a number of practical issues associated with physical aspects of the re-development identified in this research.**

Interviewees have identified issues that limit their satisfaction with the retrofit and affect their day-to-day activities, despite the positive nature of feedback overall. Such issues include the inability to lock open windows, the lack of cat flaps, the difficulty of receiving international satellite channels, and the deteriorating condition of the lawns in one block. We do not present any suggestions on how to address this, but note that as a first step, regular, clear communication is essential, especially where the issue is not amenable to residents' wishes or a compromise solution.



Further investigation of these practical issues would be valuable. To avoid partial or incorrect information filling the vacuum, it is preferable to provide open, consistent messages. A “you said, we did this in response” approach could be an effective way of tackling this.

**A series of basic core messages should be regularly targeted at those most at risk of low awareness, with particular focus on older residents.**

With regard to the Passive House/Enerphit system, targeted work with those most likely to struggle with understanding and managing the system may be beneficial. We do not propose that existing resources such as the booklet (“Your guide to no. x Erneley Close”) are abandoned, as they clearly fulfil a useful role for many residents. For some, the provision of more information, however simply presented, is likely to be superfluous. However, given the role of personal choice in absorption of such data. It may even add to any pre-existing uncertainty.

One way forward may be to concentrate on a core set of memorable phrases, which are reinforced in person by officers and/or residents’ champions (see below). These could be presented through such media as stickers on communal bins and switches, or fridge magnets. This would also help to create and re-inforce a baseline understanding as new residents move in.

Initiatives like this should go in parallel with work to challenge potentially erroneous perceptions that other residents are spending much more or that a central provider will be more costly all round. Positive, clear facts should be restated about the benefits – along the lines of “Mrs X saves £.... Compared to her old bill.”

**One Manchester should consider recruiting more residents’ champions to improve the collective understanding of Passive House/EnerPHit and its benefits.**

While the idea of a ‘resident’s champion’ is one potential solution to address any confusion over the use of and advantages associated with Passive House/EnerPHit, there are risks that such individuals are expected to solve any and all issues faced by residents and become the recipient of frustration themselves if their interventions do not lead to positive results. This risks the champion losing their initial enthusiasm and becoming disillusioned over time.

An approach to mitigating this is to recruit carefully and to clearly define the role. One option is to develop the role more extensively so that they are offered training and incentives as part of a more formal package. There is some evidence that these types of approaches, when done well, have been productive in other multiple dwelling social housing schemes in the UK. A number of case studies of ‘energy champions’ in social housing are

cited in “Championing Energy in Pendleton (Sherriff and Martin, 2016), and other sources.

**The positive benefits of Passive House should be promoted more widely.**

As the sub-region moves to a more collective, co-ordinated approach under Greater Manchester devolution, there are likely to be more opportunities to work across borders. The lessons learned (some of which are described in this report) should be shared with other housing providers who are considering retrofit projects, not the least the knowledge that a robust check of the buildings integrity should be carried out. All this would help raise One Manchester’s profile across the city and beyond.

While the Erneley Close development has attracted considerable attention within the housing sector, the findings can also be viewed as an opportunity for One Manchester to promote this development beyond this arena.. For example, the apparent health benefits of Passive House should be publicized to NHS and social care providers, while the energy efficiency aspects can be shared with initiatives like Manchester’s Low Carbon Hub, the city’s Climate Change Strategy, Family Poverty Strategy and programmes such as Valuing Older People.

**One Manchester should consider beginning future schemes from the premise that residents and landlords agree a ‘social contract’ before work starts. This agreement should be the result of joint evaluation of each side’s priorities.**

Should another similar scheme be attempted, we suggest that the initial planning should involve discussions with residents which explore a range of options to achieve greater energy efficiency. This process of negotiation can determine what aspects they might be willing to compromise on in return for lower bills, new décor, attractive appearance and an improved climate. This would have the advantage of achieving ‘buy in’ before work starts, however it needs to be embarked upon with realistic expectations of the challenge of building tenant relationships and meeting expectations.

**One Manchester should consider the equality implications of its households at Erneley Close and how they may experience (and benefit from) Passive House/EnerPHit in different ways.**

As noted above, the sample of nine respondents inevitably meant that we were only able to gain a snapshot of residents’ experiences and perceptions. It would be worthwhile to target specific research at different cohorts, particularly older residents or undertake a direct comparison between this group and younger households, or between other characteristics, e.g. men and women, single households and families, White British and BME. The local neighbourhood is very diverse and

undoubtedly the make-up of households at Erneley Close will change over time and with it the needs and priorities of tenants. How this is captured and acted on must be a consideration for One Manchester going forward.

### 6.2.1 Further research

As is the case in any piece of research, this study, and the discussions following on from it, has identified areas that would be of interest for further enquiry.

- How can we better understand the performance of large-scale retrofit? What effect, for example, does the requirement for insulation to be placed around the whole building, rather than around individual units, have on performance?
- What issues does Right to Buy present to large-scale retrofit and communal heating? How can it be ensured that owner occupiers continue to benefit from and adhere to PassivHaus standards?
- To what extent might PassivHaus performance change over time? Can the current level of performance be maintained over a period of tenant turnover, demographic change, and ongoing maintenance?
- Is there evidence that the retrofit project has impacted upon wider social issues, such as health and wellbeing, pride in the area and anti-social behaviour?
- How and in what ways have the retrofit project influenced the relationship between One Manchester and its tenants, both in Erneley close and elsewhere?

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