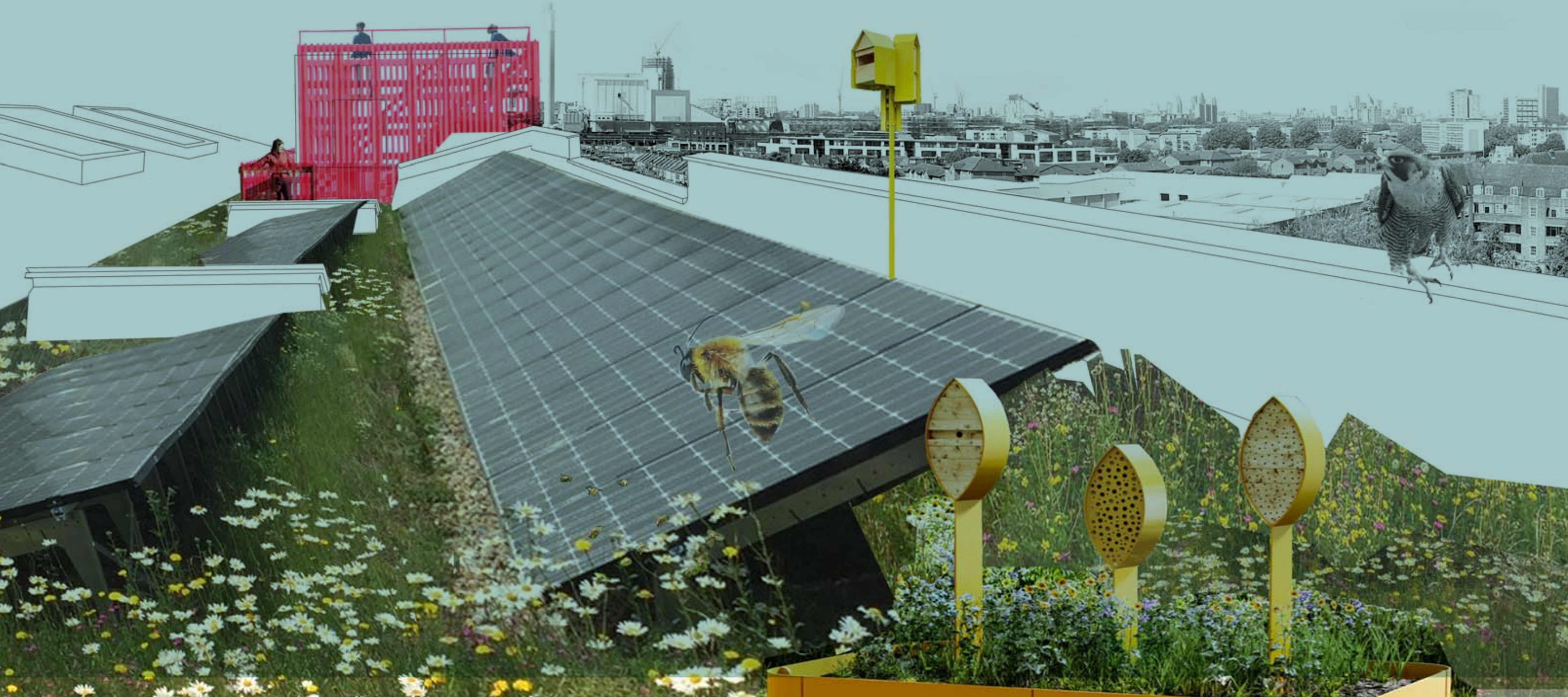
Pepys Power & Hypergreening

Evelyn *Garden Ward* Catalyst Project



WonKy

Bence House
Tenants Residents Association

RIBA Stage 1
December 2024

Bence House
Tenants Residents Association

Foreword: Hope and Superheroic Aims

The climate emergency is a big ask for communities and individuals alike, after all saving the planet is a superheroic aim.

As the climate emergency becomes ever more urgent, there is a sense of events being out of control and communities not having any real power to help in anyway. Yet the sustainability aims often expressed as an overlapping trinity of “Environmental”, “Economic” and “Social” tend to underestimate the “Social” and misunderstand that whilst each branch mutually supports the others it is people that matter. It is people, us, the communities and individuals that foster change. Helping one branch, helps the others. The Bence House Pilot, The Pepys Power and Hypergreening Project, is Bence House’s modest contribution to this fight for the planet, and it comes from the community - the “Social”. If we can realise the full project then the environmental and economic elements become self-evident: the biosolar roof will provide green energy, the green roof will support water management reducing surface water flooding, and biodiversity. The roof will also alleviate the city heat sink effect in summer. The proposed ground source heat pumps, together with the suggested building fabric improvement will massively reduce bills and CO2 emissions for the whole block. The economic value to the community will be direct, yet the long-term saving for the social landlord is self-evident too, less CO2, less maintenance, no gas boiler maintenance, less people requiring support for fuel poverty, or less help during drought as the building will be cooler in hot summers. There is added value to the asset, the payback time for the investment is better than it’s ever been and improving; solar cells continue to drop in cost with an estimated 6-year payback and the economic case for ground source heat pumps is compelling at this scale. Bence House is intended to be a pilot, and if there are brave souls in the council that support the project then the vision of the Pepys Estate achieving net zero is tantalisingly close. If the seven other sister blocks to Bence House are equally improved, then there would be economics of scale to be had. The reach and benefits of the project are much greater than the sum of its parts and would represent an intelligent, sustainable use of resources. The intangible social benefits to wellbeing and mental health will be positively immeasurable. WonKy’s excellent report goes beyond Bence House’s initial vision, holistically incorporating viable sustainable strategies and providing a road map so we can take the first steps. If we can rally all the people: the residents, leaseholders, the councillors, the council and housing officials behind this vision then there is hope, and we all feel that we are all not so overwhelmed, maybe even a little superheroic too.

Dev Bharadia
On Behalf of Bence House Tenants and Residents Association

Front Cover: Concept design for a biosolar roof for Bence House: a community amenity and natural green space

Contents

Preface

Pepys Power & Hypergreening is a Catalyst Project identified by *Greening Evelyn,* published by the National Trust in 2024, to help explore the Evelyn Ward community's aspirations for improving access to green space, alongside support to co-develop their vision.

Greening Evelyn sets out a vision for Evelyn Ward to aspire to be the first Garden Ward in Lewisham; a statement of intent where the whole ward is considered a garden, a green public realm, for local residents to enjoy. Informed by community engagement and input from a wide range of stakeholders *Greening Evelyn* aims to make the existing parks, the pavements and roads, housing, shops, and businesses, greener and more accessible for everyone to enjoy and, equally, is designed to help community groups and local authorities to facilitate green space improvements.

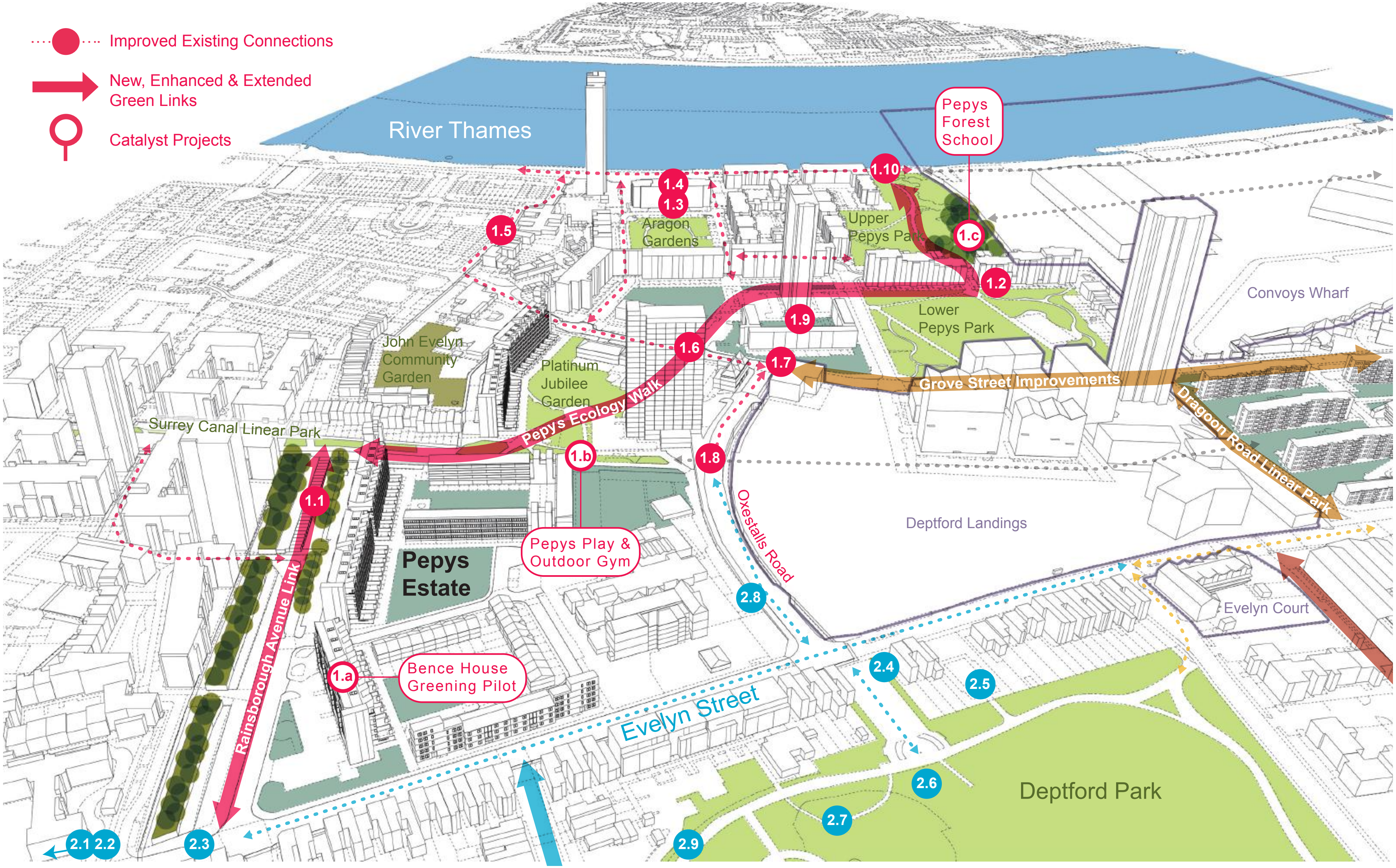
The vision for The Pepys Estate looks to reveal hidden places and link them to existing green spaces, to increase impact and footfall: not simply about adding more green and more planting, but an ambition to make existing green spaces and public realm work harder for people and nature.

By creating, extending and enhancing green links and spaces through the neighbourhood, the ambition is to improve access to green space, increase biodiversity, address the climate emergency, and celebrate what is already growing and living in the area. The primary components of the neighbourhood vision are: a suite of improvements to existing green space connections; ideas for new, extended and enhanced green links; and potential catalyst projects.

Catalysts are deliverable projects, achievable with relatively modest budgets and in reasonable time-scales; small in scale but impactful. Catalyst projects have been identified as both improving existing green space connections and helping to establish the network of *Greening Evelyn* Links. Importantly, feedback during the consultation process has identified Catalyst projects that appear to enjoy community and political support.

Community and user engagement is accommodated throughout the planning of Catalyst Projects, to ensure the design continues to meet the needs of the community and that a wide group of users is reached. A successful community-led project should have a sense of community ownership from concept, through design development to delivery and use.

The *Pepys Power and Hypergreening* Project is a community power generation and greening feasibility study. Bence House Tenants and Residents Association (TRA) have been awarded NCIL funding to carry out a feasibility study and consultation exercise to see if measures can be applied to a housing block, such as their own, to deliver clean power, clean air, and prevent surface water retention. This study was activated by curious residents learning that the block's roof is due for replacement. If successful it is hoped that the proposals could be rolled out across the estate maximising efforts in the Climate Emergency.



The Pepys Estate Neighbourhood Vision from *Greening Evelyn (2024)*: connecting Deptford Park to The Thames

A Introduction & Context

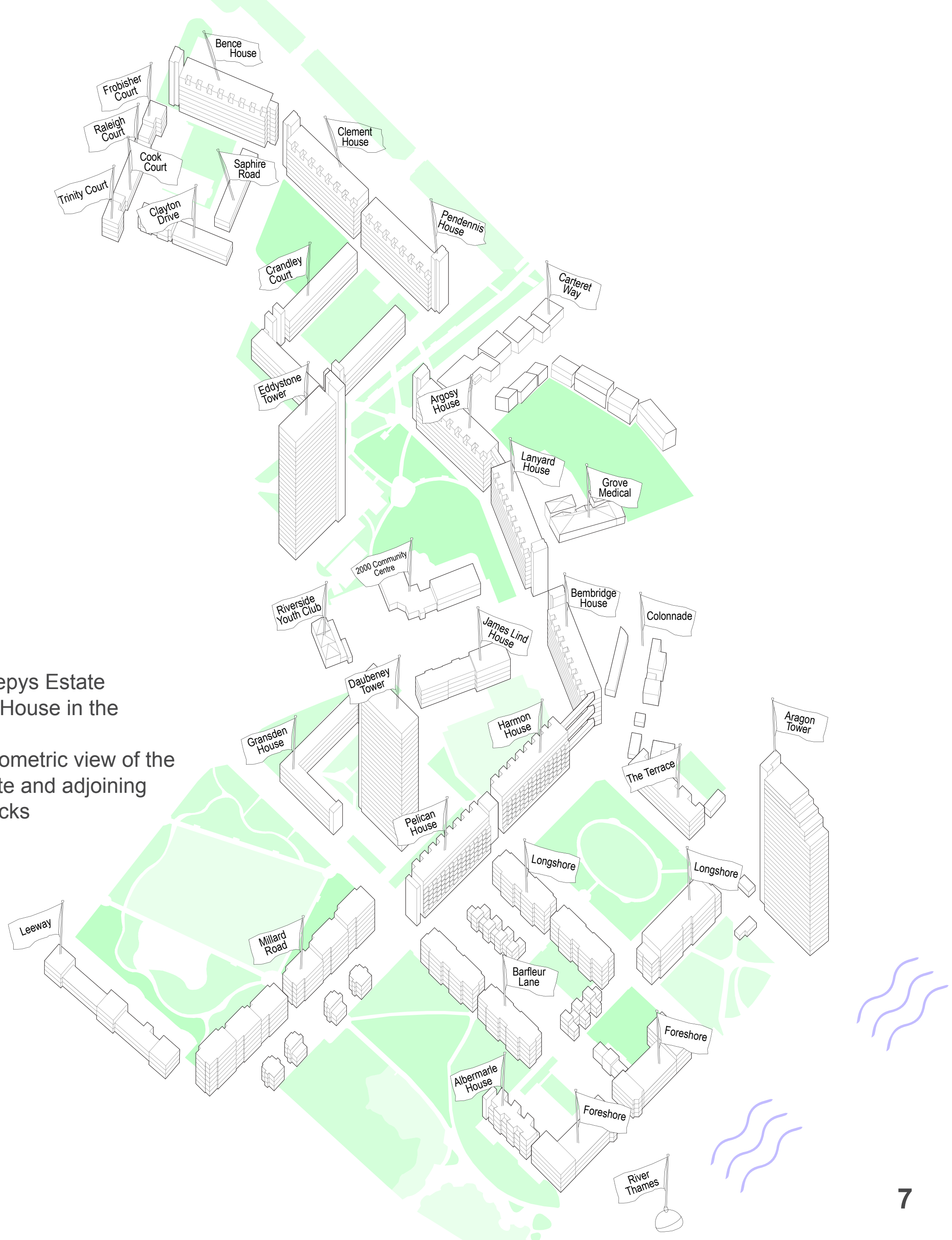
1_The Pepys Estate

Following the devastating effects of WW2, the County of London Plan sought to recreate the city, including slum clearances, and change the urban fabric of Deptford. From the rubble and pulled up terraced roads, new housing estates and parks were created including The Pepys Estate, along with Upper and Lower Pepys Park. Built with social ambition and hope for the future, The Pepys Estate, built on the former Naval victualling yard was completed in 1973 for 'the peaceful enjoyment and well-being of Londoners'. The red brick blocks combined some of the most advanced and innovative design principles of the day. The Greater London Council (GLC) believed 'It would be, from the outset, a community – a cradle to grave exemplar of welfare state ideals'. As the GLC brochure celebrating the new estate proudly proclaimed, 'in planning the estate, one of the main themes has been the separation of pedestrian from vehicular traffic'. This was achieved by an extensive series of elevated walkways connecting many of the blocks. Long term residents remember a time when you could walk from Deptford Park to the river without your feet ever touching the ground. The principles and care that were applied to the Estate's planning and construction were rewarded with a Civic Trust Award (1967) in recognition of 'its impeccable design'.

The socio-economic conditions of the 1970s and 1980s, including high unemployment, had a profound impact on Lewisham, notably on its residents and the housing estates where many lived. In the 1990s, many regeneration initiatives were introduced in Lewisham with a hope of urban renewal for the area. A report by the British Urban Regeneration Association looking back on the 1990s, noted that Deptford had experienced 'every kind of UK regeneration programme' while 'Evelyn and New Cross wards …remain within the most deprived 10% of English neighbourhoods'. The Pepys Estate Action Plan proposed refurbishing the existing buildings and constructing new mixed-use blocks with social housing but these plans were never realised. One block of flats, Merrick House, was replaced, not with new housing, but with low-rise shops and the 2000 Community Action Centre, and these continue to serve the community today.

The estate is currently comprised of several 4 storey blocks, eight 8-storey blocks (including the subject of this report: Bence House) and two-24 storey tower blocks. The urban design of the estate is a series of courtyards accommodating semi-public gardens providing (or potentially providing) valuable external amenity space in addition to publicly accessible parks. Some of these green spaces provide small-scale amenities including play spaces and have mature trees but many are underused and of poor quality.

(left) The Pepys Estate with Bence House in the foreground
(right) Axonometric view of the Pepys Estate and adjoining housing blocks



2_Brief, Standards & Policy

Community Brief

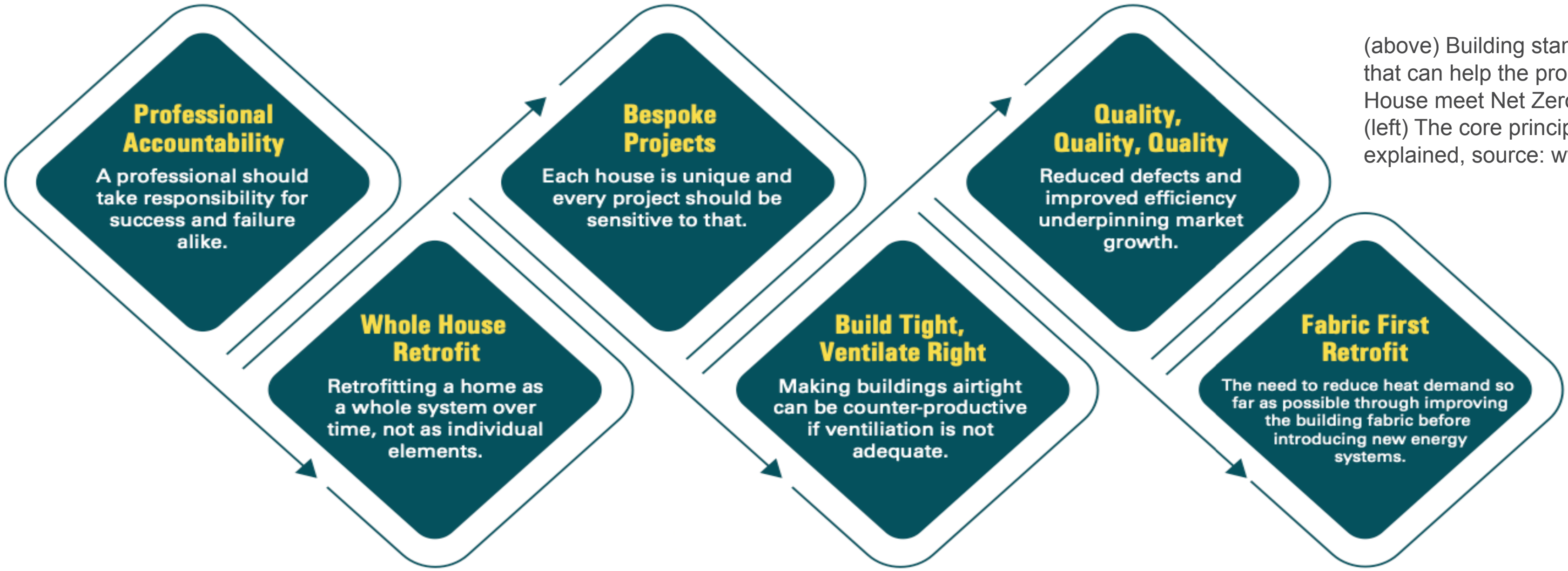
The project is a community-led, power generation and hypergreening feasibility study that aims to meet Lewisham Council's Neighbourhood Community Infrastructure Levy (NCIL) regulations: to improve infrastructure and address demands of development on the area. The Bence House Tenants and Residents Association (TRA) began thinking about power and greening due to the imminent need to renovate the degraded roof of their block. This started a discussion about the potential of improving the roof's energy efficiency, incorporating a green roof, and installing solar panels. Consequently, the combination of a green roof with solar panels, known as a biosolar roof, was identified by residents as a concept to test in this study. A biosolar roof can help purify the air, reduce rainwater runoff, promote biodiversity and support ecology, and generate clean renewable electricity. In line with the concept proposed by the TRA for the NCIL grant, WonKy have proposed a community-led research project, complemented by technical analysis, to investigate the feasibility of incorporating power and greening measures into the building envelope of Bence House. Furthermore, WonKy will take a holistic approach to analysing the environmental design of Bence House, investigating issues and opportunities to create more energy-efficient, healthy and comfortable homes for the residents. This project could be rolled out across other blocks on the estate maximising efforts in the Climate Emergency, and may also be useful as a reference for other social housing stock in Lewisham.

PAS 2035 - Mandatory Retrofit Standard

PAS 2035 is a British Standard that outlines how to retrofit a home to improve its energy efficiency. PAS 2035 is mandatory for all retrofit programs that use government funding, including those funded by the *Warm Home: Social Housing Fund*, *Energy Company Obligation*, and *Local Authority Delivery Scheme*. PAS 2035 requires a "whole house" approach that considers the home, environment, occupancy, and the householder's improvement objectives. It helps to ensure that every step of the retrofit process is managed by knowledgeable experts, which can minimise errors and ensure high-quality outcomes. This report is intended to be a catalyst for a PAS 2035 framework and lay the foundations for this process by providing data and analysis on the building, and articulating the improvement objectives of residents and their ambitions for a more sustainable, greener environment. PAS 2035 retrofit roles include certified Assessors, Coordinators, Designers, Evaluators and Installers amongst others. Lewisham Council will appoint competent people to these roles and explain their responsibilities to residents. PAS 2035 identifies a 'risk pathway' for each project and Bence House will be on the highest risk pathway due to its size, complexity and that multiple measures will be planned over time. Following this report Lewisham Council should commission a retrofit assessment of Bence House by a Retrofit Assessor with a track record working on complex buildings, multi-unit housing, and similar construction to the Pepys Estate. The assessment will deliver a comprehensive evaluation of the building's current condition to enable the delivery of a strategy of suitable energy efficiency measures, including information on cost and lifespan of measures. Further on, as the retrofit design and specification are progressed, a medium-term plan will be developed, outlining the measures needed to improve energy efficiency over the coming years.

Net Zero Building Standards

In addition to following the mandatory PAS 2035 retrofit framework, it is important that the proposed energy efficiency measures at Bence House are delivering homes that are energy efficient, and align with the ambitions of Lewisham's Climate Emergency Action Plan by targeting a proven Net Zero carbon building standard. Following this report, Lewisham Council, Bence House residents, the Retrofit Coordinator and Assessor, should review the project objectives and consider building standards and certification that should be targeted. A new *UK Net Zero Building Standard*, developed by a wide range of stakeholders, has launched in 2024 which can be looked at, alongside other established standards from the *Building Research Establishment* (BRE) and the *Low Energy Transformation Initiative* (LETI).



(above) Building standards and certifiers that can help the proposed work at Bence House meet Net Zero;
(left) The core principles of PAS 2035 explained, source: www.retrofitacademy.org

Lewisham Council, Housing & Net-Zero

Housing in Lewisham is responsible for 51% of the borough's total carbon emissions. The Council manages over 19,000 homes, many of which have low energy efficiency standards. Retrofitting these homes is essential for reducing emissions. Additionally, with a quarter of residents renting privately and about half owning their homes, improving energy efficiency in the private sector is crucial. A key strategy is reducing heating needs through retrofitting homes, lowering energy costs and ensuring residents stay warm. Lewisham Council has secured funding from the Government's *Warm Homes: Social Housing* [Decarbonisation] *Fund* to enhance energy efficiency in council homes. This funding will support a retrofit program aimed at improving the energy performance of the Council's social housing stock. The plan focuses on properties from the damp and mould register and includes potential work on the Pepys & Evelyn Estates. The grant provides funding for homes with poor energy performance ratings and additional funding opportunities are available for decarbonising heat in specific locations on the Pepys Estate. This is a multi-million pound program, funded by the grant and matched funding, while also acknowledging larger complementary projects. The Pepys Estate is a key focus due to urgent needs in the 24-storey tower blocks, with ongoing feasibility studies for solutions like ground source heat pumps. The council plans appear to enjoy strong political support from local elected officials. Lewisham Council are also collaborating with companies that offer complementary services, roofing and solar panels for example, to decarbonise their housing stock. These companies work together and can access further funding streams such as *ECO4* (council homes) and *GBIS* (leasehold properties), as well as leveraging private finance and community energy funds to carry out work in Lewisham. The council also offers a support service for households facing high heating costs, providing practical assistance such as energy-saving tips, boiler servicing, and help with funding for insulation and heating upgrades. Regarding private, rented properties, Lewisham Council's new selective licensing scheme covers an additional 20,000 privately rented properties, requiring them to meet minimum energy efficiency standards. This initiative aims to reduce fuel poverty and overall energy consumption in the borough.

Sustainable Housing priorities for 2024/25 from Lewisham Council's *Climate Emergency Action Plan 2024*

3_Report Evidence

New research has been undertaken for this report to provide evidence to support the analysis and recommendations.

Archival Research

When WonKy were commissioned for this project, neither Lewisham Council (Housing) or the Bence House TRA had access to architectural drawings of Bence House. The Pepys Estate is a sophisticated architectural design with a mix of unit types with complex layouts including ‘scissor flats’ that overlap in section and plan. Consequently, WonKy undertook archival research at the London Metropolitan Archives and the Royal Institute of British Architects finding historic documents from the 1960s enabling WonKy to prepare a set of floor plans and sections of the Bence House block type (Supplementary Material - 1). Furthermore, this research enabled WonKy to categorise Bence House dwellings into different typologies.

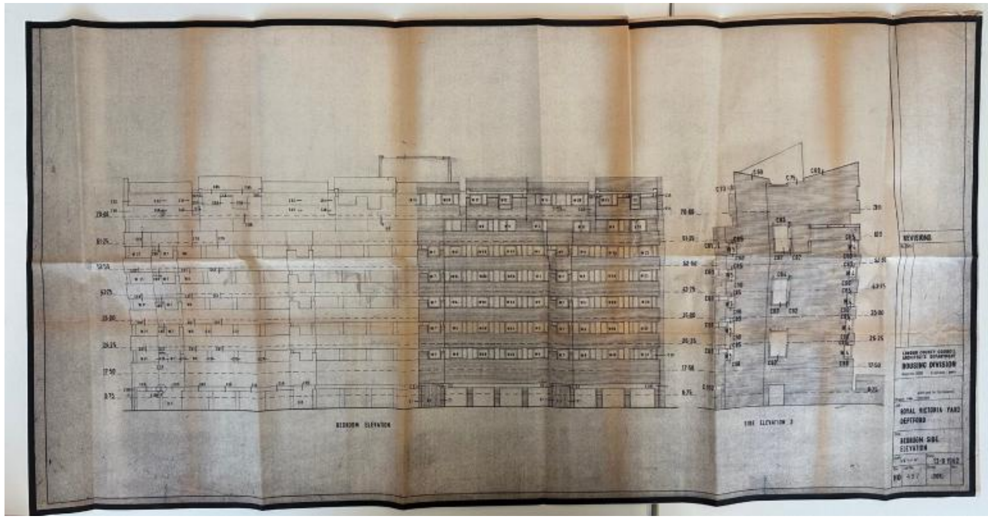
Resident Engagement

Central to a community-led project is continual and meaningful engagement with residents. Equally, the mandatory retrofit standard (PAS 2035, see introduction) sees each home as unique and ‘every project should be sensitive to that’ - further reinforcing the need for engagement from the outset. Consequently, WonKy offered home consultations to the residents of Bence House, where the homes could be inspected in-person and an in-depth conversation with the residents could be held. The offer was promoted at the Bence House TRA annual meeting and posters placed in the communal areas.

Draft home consultation reports were then sent to the residents for feedback before the final versions were compiled (Supplementary Material - 2)

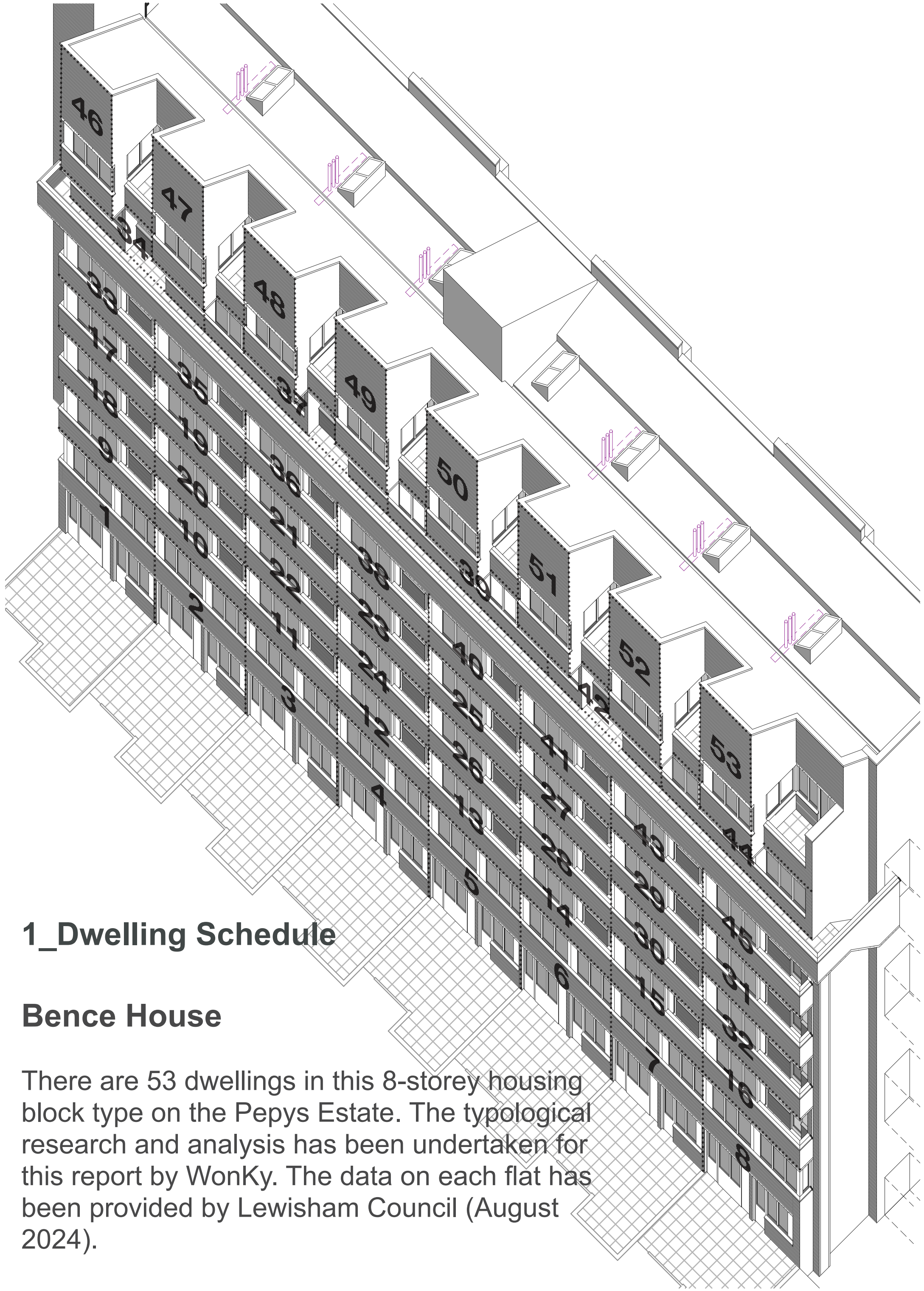
Specialist Consultation

Lewisham Council Net Zero team connected WonKy with specialist companies working with the council including Bauder (flat roofing), Carbon3 (solar panel systems), Kensa (heat pumps), Solshare (solar power distribution). In addition to expertise in delivering their respective services, these companies have knowledge of working within Lewisham Council and have access to funding such as the *Energy Company Obligation* (*ECO4*) scheme and the *Great British Insulation Scheme* (*GBIS*).



Example of architectural drawings found in the London Metropolitan Archives, an elevation of an 8-storey block at Royal Victoria Yard (name of the Pepys Estate development in 1962)

B
The Dwellings



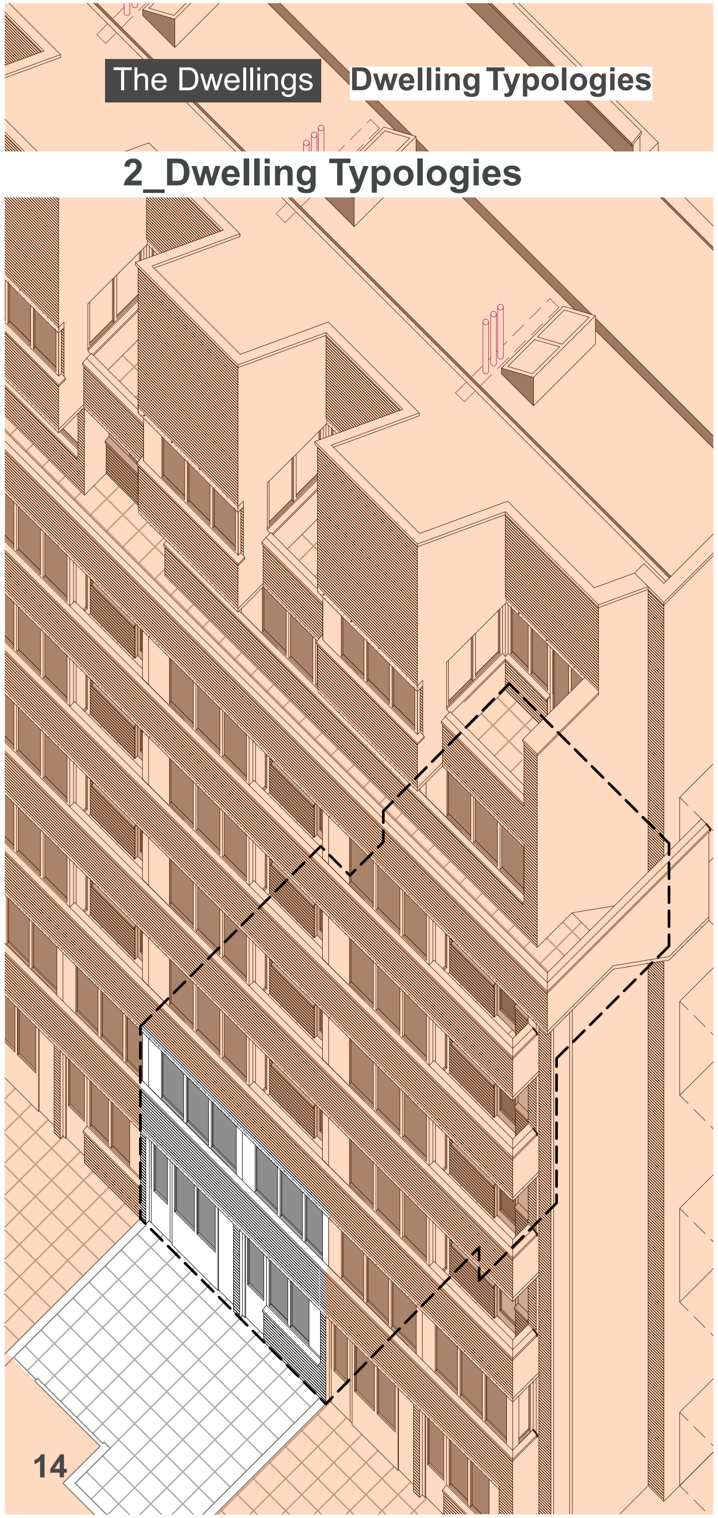
1_Dwelling Schedule

Bence House

There are 53 dwellings in this 8-storey housing block type on the Pepys Estate. The typological research and analysis has been undertaken for this report by WonKy. The data on each flat has been provided by Lewisham Council (August 2024).

Address	TYPOLOGY	ACCESS FLOOR	Leaseholder	Accurate SAP	Accurate EPC	Est SAP	Est EPC	Lodged SAP	Lodged EPC	Lodgement Date	Heating	Main Fuel
1 BENCE HOUSE, RAINSBOROUGH AVENUE, London	A2	G	NO	69.00	C	69.00	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
2 BENCE HOUSE, RAINSBOROUGH AVENUE, London	A1	G	NO	74.00	C	75.74	C	74.00	C	22/12/2021	Boiler: A rated Regular Boiler	Gas: Mains Gas
3 BENCE HOUSE, RAINSBOROUGH AVENUE, London	A2	G	NO	72.00	C	72.34	C	72.00	C	01/06/2021	Boiler: A rated Regular Boiler	Gas: Mains Gas
4 BENCE HOUSE, RAINSBOROUGH AVENUE, London	A1	G	YES	74.00	C	72.26	C	74.00	C	03/08/2020	Boiler: C rated Combi	Gas: Mains Gas
5 BENCE HOUSE, RAINSBOROUGH AVENUE, London	A2	G	NO	68.80	C	68.80	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
6 BENCE HOUSE, RAINSBOROUGH AVENUE, London	A1	G	NO	73.34	C	73.34	C				Boiler: A rated Combi	Gas: Mains Gas
7 BENCE HOUSE, RAINSBOROUGH AVENUE, London	A2	G	NO	69.89	C	69.89	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
8 BENCE HOUSE, RAINSBOROUGH AVENUE, London	A1	G	YES	71.00	C	60.94	D	71.00	C	03/08/2016	Boiler: G rated Combi	Gas: Mains Gas
9 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B2	2	YES	60.00	D	72.35	C	60.00	D	25/10/2021	Boiler: F rated Combi	Gas: Mains Gas
10 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B1	2	NO	64.02	D	64.02	D	69.00	C	12/09/2012	Boiler: A rated Regular Boiler	Gas: Mains Gas
11 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B2	2	NO	74.00	C	70.11	C	74.00	C	12/01/2015	Boiler: A rated Regular Boiler	Gas: Mains Gas
12 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B1	2	YES	75.00	C	78.86	C	75.00	C	27/02/2023	Boiler: C rated Combi	Gas: Mains Gas
13 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B2	2	NO	73.00	C	69.99	C	73.00	C	30/01/2015	Boiler: A rated Regular Boiler	Gas: Mains Gas
14 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B1	2	YES	81.00	B	74.55	C	81.00	B	28/01/2015	Boiler: C rated Combi	Gas: Mains Gas
15 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B2	2	YES	75.13	C	75.13	C				Boiler: C rated Combi	Gas: Mains Gas
16 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B1	2	YES	63.84	D	63.84	D	70.00	C	29/01/2013	Boiler: A rated Regular Boiler	Gas: Mains Gas
17 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B4	4	YES	62.69	D	62.69	D	64.00	D	17/12/2012	Boiler: C rated Combi	Gas: Mains Gas
18 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C2	4	NO	72.26	C	72.26	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
19 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B3	4	YES	74.00	C	71.30	C	74.00	C	11/07/2019	Boiler: F rated Combi	Gas: Mains Gas
20 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C1	4	YES	54.35	E	54.35	E	73.00	C	13/01/2012	Boiler: E rated Combi	Gas: Mains Gas
21 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B4	4	NO	68.00	D	66.88	D	68.00	D	05/08/2014	Boiler: A rated Regular Boiler	Gas: Mains Gas
22 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C2	4	YES	69.00	C	70.32	C	69.00	C	26/08/2020	Boiler: F rated Combi	Gas: Mains Gas
23 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B3	4	NO	71.61	C	71.61	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
24 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C1	4	NO	70.85	C	70.85	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
25 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B4	4	NO	75.00	C	73.80	C	75.00	C	02/07/2023	Boiler: A rated Regular Boiler	Gas: Mains Gas
26 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C2	4	YES	71.17	C	71.17	C	70.00	C	21/02/2013	Boiler: A rated Combi	Gas: Mains Gas
27 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B3	4	YES	80.00	C	74.02	C	80.00	C	10/06/2023	Boiler: F rated Combi	Gas: Mains Gas
28 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C1	4	YES	68.00	D	73.04	C	68.00	D	23/05/2017	Boiler: F rated Combi	Gas: Mains Gas
29 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B4	4	NO	70.15	C	70.15	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
30 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C2	4	NO	72.19	C	72.19	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
31 BENCE HOUSE, RAINSBOROUGH AVENUE, London	B3	4	YES	75.00	C	71.33	C	75.00	C	16/02/2017	Boiler: E rated Combi	Gas: Mains Gas
32 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C1	4	YES	68.51	C	68.51	C	63.00	D	10/08/2009	Boiler: F rated Combi	Gas: Mains Gas
33 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C2	6	NO	77.12	C	77.12	C				Boiler: A rated Combi	Gas: Mains Gas
34 BENCE HOUSE, RAINSBOROUGH AVENUE, London	D2	6	YES	73.00	C	71.40	C	73.00	C	15/02/2020	Boiler: E rated Combi	Gas: Mains Gas
35 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C1	6	YES	71.00	C	73.95	C	71.00	C	12/11/2023	Boiler: F rated Combi	Gas: Mains Gas
36 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C2	6	NO	72.43	C	72.43	C	78.00	C	13/07/2010	Boiler: A rated Regular Boiler	Gas: Mains Gas
37 BENCE HOUSE, RAINSBOROUGH AVENUE, London	D1	6	YES	54.00	E	76.22	C	54.00	E	25/08/2020	Boiler: F rated Combi	Gas: Mains Gas
38 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C1	6	YES	68.00	D	68.52	C	68.00	D	28/02/2015	Boiler: F rated Combi	Gas: Mains Gas
39 BENCE HOUSE, RAINSBOROUGH AVENUE, London	D2	6	NO	79.12	C	79.12	C				Boiler: A rated Combi	Gas: Mains Gas
40 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C2	6	NO	60.98	D	60.98	D	68.00	D	23/09/2012	Boiler: A rated Regular Boiler	Gas: Mains Gas
41 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C1	6	NO	77.00	C	74.62	C	77.00	C	24/09/2019	Boiler: A rated Combi	Gas: Mains Gas
42 BENCE HOUSE, RAINSBOROUGH AVENUE, London	D2	6	NO	76.58	C	76.58	C				Boiler: E rated Combi	Gas: Mains Gas
43 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C2	6	YES	73.24	C	73.24	C	68.00	D	12/11/2013	Boiler: C rated Combi	Gas: Mains Gas
44 BENCE HOUSE, RAINSBOROUGH AVENUE, London	D2	6	NO	72.70	C	72.70	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
45 BENCE HOUSE, RAINSBOROUGH AVENUE, London	C1	6	NO	72.10	C	72.10	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
46 BENCE HOUSE, RAINSBOROUGH AVENUE, London	E2	6	NO	75.43	C	75.43	C				Boiler: A rated Combi	Gas: Mains Gas
47 BENCE HOUSE, RAINSBOROUGH AVENUE, London	E1	6	NO	59.00	D	71.98	C	59.00	D	10/05/2019	Boiler: A rated Regular Boiler	Gas: Mains Gas
48 BENCE HOUSE, RAINSBOROUGH AVENUE, London	E2	6	NO	75.82	C	75.82	C				Boiler: A rated Combi	Gas: Mains Gas
49 BENCE HOUSE, RAINSBOROUGH AVENUE, London	E1	6	NO	57.00	D	71.59	C	57.00	D	07/04/2016	Boiler: A rated Regular Boiler	Gas: Mains Gas
50 BENCE HOUSE, RAINSBOROUGH AVENUE, London	E2	6	NO	72.23	C	72.23	C				Boiler: A rated Regular Boiler	Gas: Mains Gas
51 BENCE HOUSE, RAINSBOROUGH AVENUE, London	E1	6	YES	71.00	C	75.04	C	71.00	C	11/11/2018	Boiler: C rated Combi	Gas: Mains Gas
52 BENCE HOUSE, RAINSBOROUGH AVENUE, London	E2	6	YES	66.00	D	75.13	C	66.00	D	26/05/2022	Boiler: C rated Combi	Gas: Mains Gas
53 BENCE HOUSE, RAINSBOROUGH AVENUE, London	E1	6	YES	71.00	C	75.90	C	71.00	C	20/03/2023	Boiler: C rated Combi	Gas: Mains Gas

2_Dwelling Typologies



TYPE A

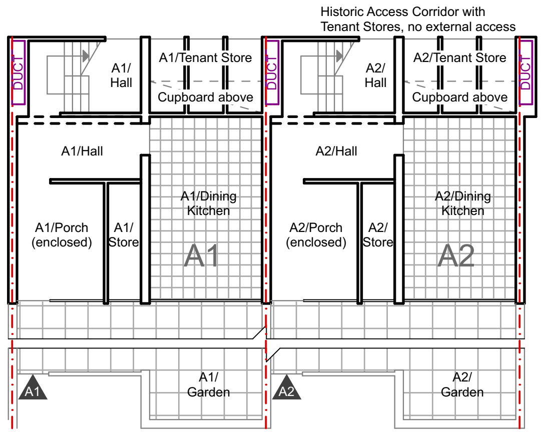
2-level maisonette over garages with garden

A1 - 4 Bedrooms
Ground & First Floor Dwellings 2/4/6/8 (4 no.)
120sqm gross internal floor area, excluding externally accessed stores

A2 - 3 Bedrooms
Ground & First Floor Dwellings 1/3/5/7 (4 no.)
112sqm gross internal floor area, excluding externally accessed stores

Access to Type A is from private gardens on ground floor. The historic access corridor with tenant stores is no longer accessible externally.

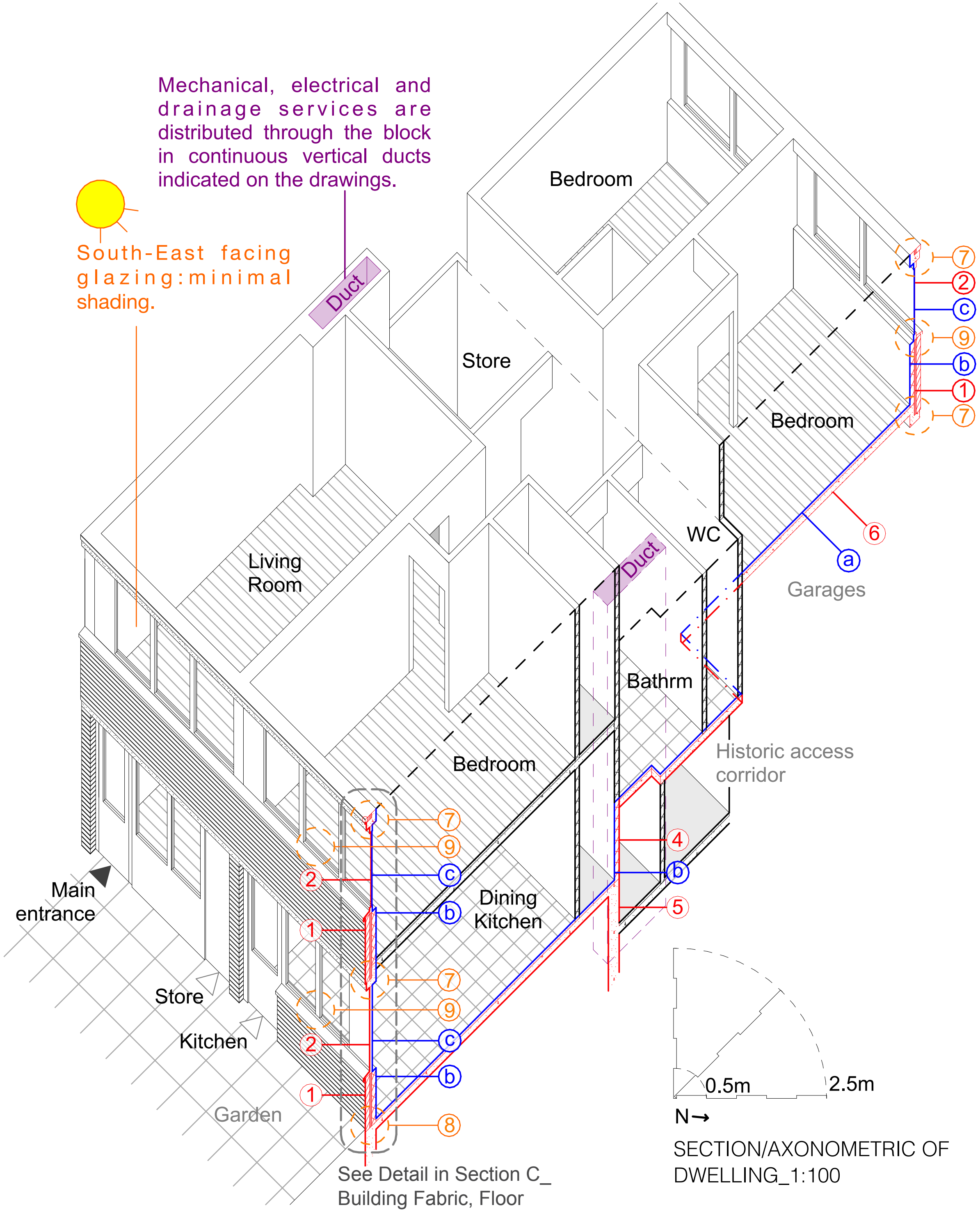
FIRST FLOOR PLAN



GROUND FLOOR PLAN

CROSS SECTION_1:200

A = Access Corridor



SECTION/AXONOMETRIC OF DWELLING_1:100

For an explanation of what is meant by the building envelope, thermal bridges and airtightness, see 'Section C - Building Fabric'

BUILDING ENVELOPE

1 Cavity wall with facing brick outer leaf, 2" cavity, masonry inner leaf. Long-term residents recollect injected cavity insulation has been installed.

2 Non-original double-glazed PVCu windows, spandrel panels and doors. Site observation and resident comments, suggests some glazing units may be degraded.

3 Uninsulated ground-bearing solid floor, 5" concrete slab with 2" screed over.

4 Uninsulated 9" masonry wall to unheated spaces.

5 Uninsulated solid retaining wall.

6 Uninsulated solid floor over unheated spaces, 5" concrete slab with 2" screed over.

THERMAL BRIDGES

7 Concrete structure exposed externally at floor levels resulting in a thermal bridge.

8 Junction of solid floor slab and cavity wall with injected insulation resulting in a thermal bridge.

9 Window installation detail is unknown but may be a poor performing thermal bridge.

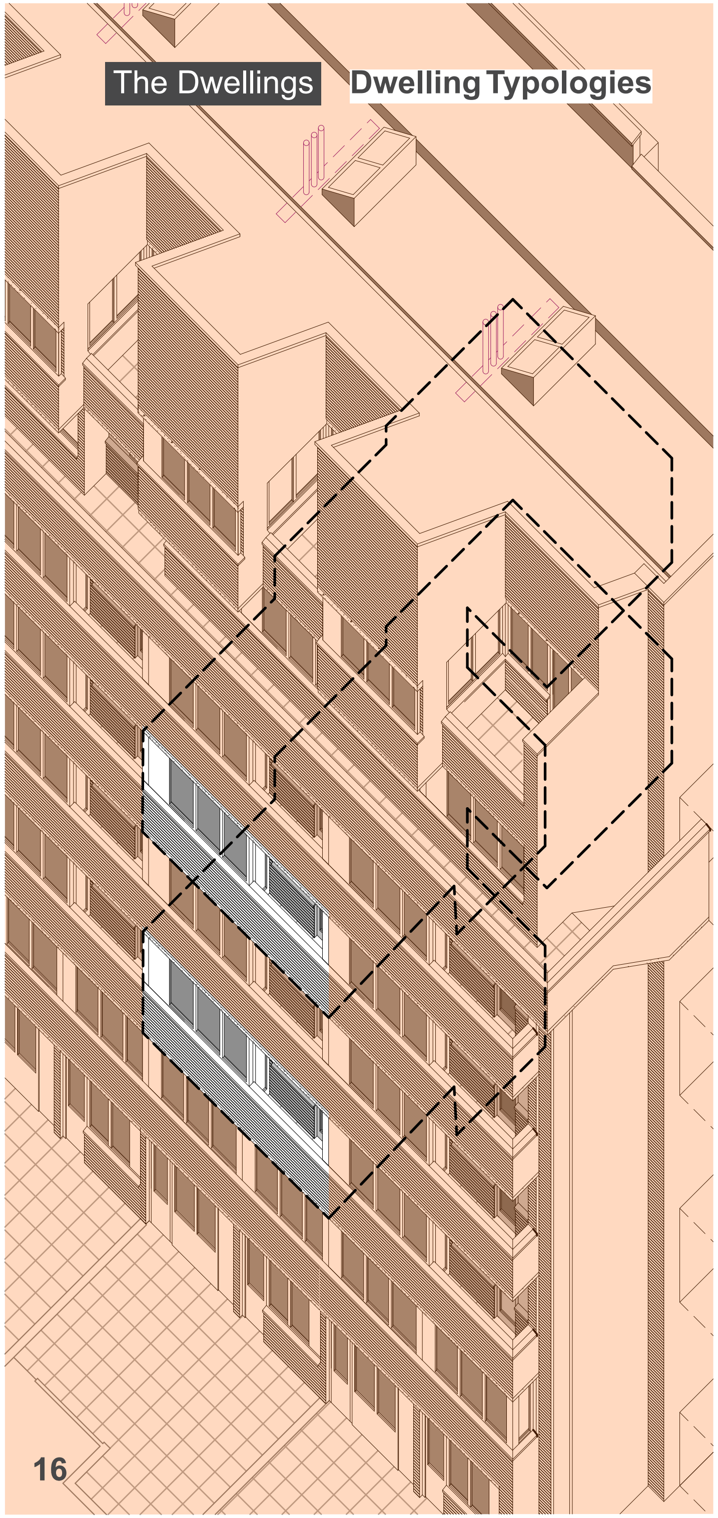
AIRTIGHTNESS

a 7" screed/concrete solid floor construction is likely to be intrinsically airtight.

b Airtightness of wall will depend on type, quality and continuity of masonry, injected cavity insulation (if present), internal plaster.

c Airtightness of window unit and installation within cavity wall is unknown.

Construction composition and sizes are assumptions based on visual checks and archival research

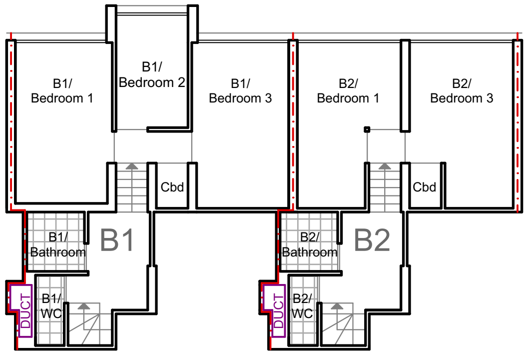


TYPE B

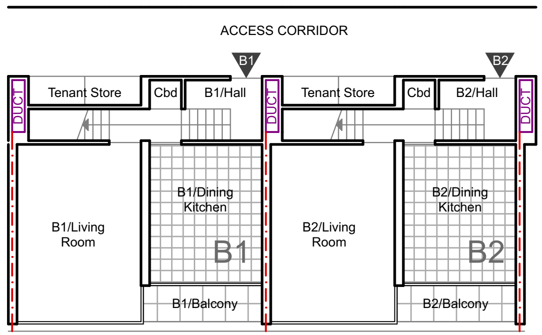
2-level 'Up' scissor flats

B1 - 3 Bedrooms
Second & Third Floor Dwellings 10/12/14/16 (4 no.)
Access from Second Floor access corridor and hall.
77sqm gross internal floor area, excluding balconies and access corridor storage.

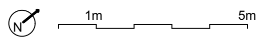
B2 - 2 Bedrooms
Second & Third Floor Dwellings 9/11/13/15 (4 no.)
Access from Second Floor access corridor and hall.
69sqm gross internal floor area, excluding balconies and access corridor storage.



UPPER LEVEL PLAN



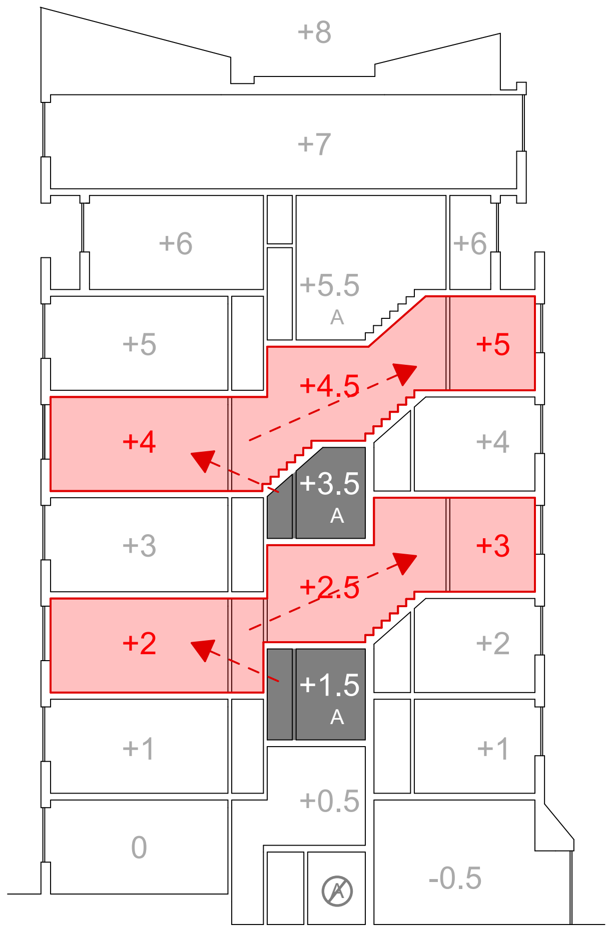
LOWER LEVEL PLAN



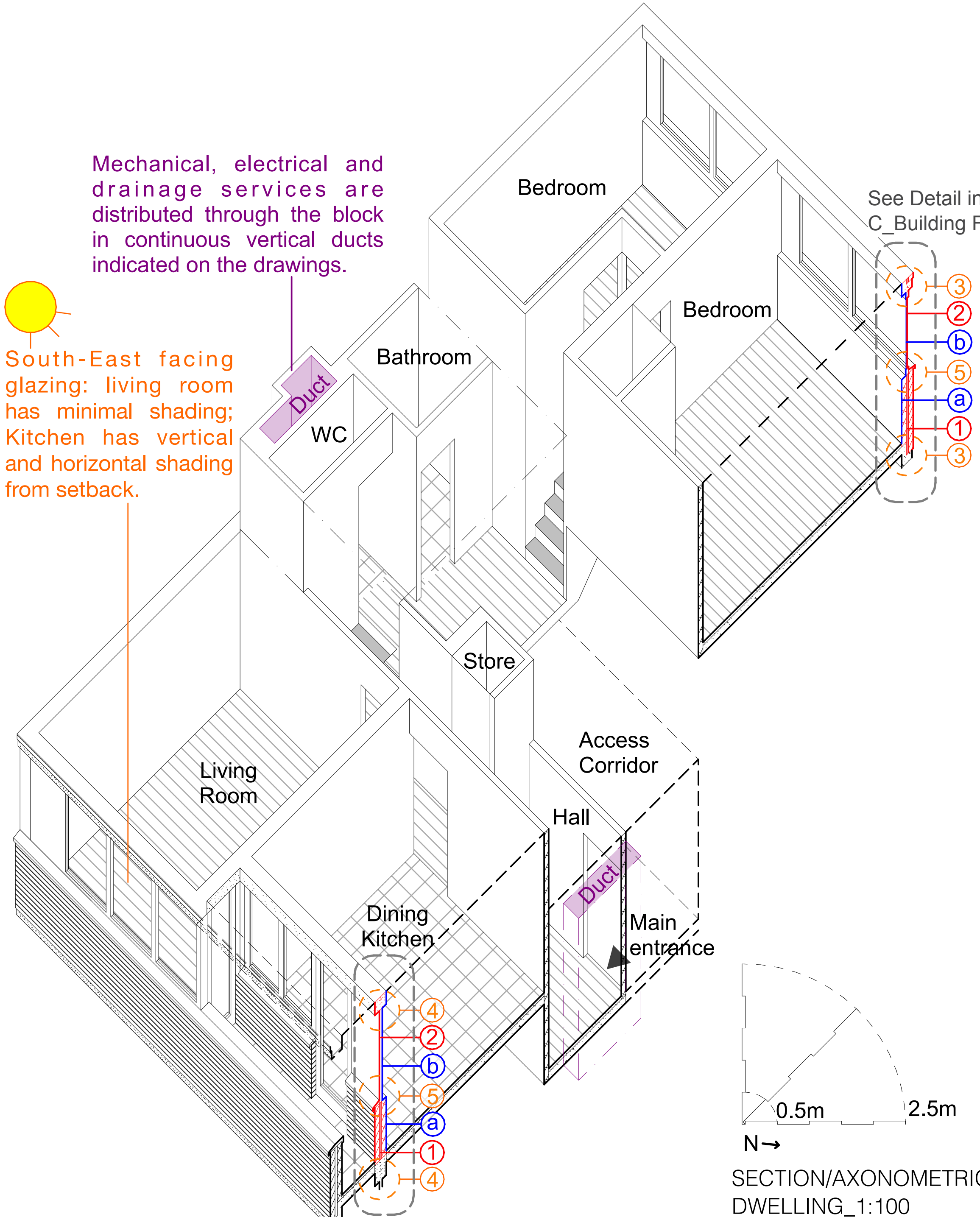
B3* - 3 Bedrooms
Fourth & Fifth Floor Dwellings 19/23/27/31 (4 no.)
Access from Fourth Floor access corridor and hall.
77sqm gross internal floor area, excluding balconies and access corridor storage.

B4* - 2 Bedrooms
Fourth & Fifth Floor Dwellings 17/21/25/29 (4 no.)
Access from Fourth Floor access corridor and hall.
69sqm gross internal floor area, excluding balconies and access corridor storage.

* **B3/B4** - versions of B1/B2 with minor variations to internal storage layout and hallway and stair are mirrored.



CROSS SECTION_1:200
A = Access Corridor



SECTION/AXONOMETRIC OF DWELLING_1:100

For an explanation of what is meant by the building envelope, thermal bridges and airtightness, see 'Section C - Building Fabric'

BUILDING ENVELOPE

1 Cavity wall with facing brick outer leaf, 2" cavity, masonry inner leaf. Long-term residents recollect injected cavity insulation has been installed.

2 Non-original double-glazed PVCu windows, spandrel panels and doors. Site observation and resident comments, suggests some glazing units may be degraded.

THERMAL BRIDGES

3 Concrete structure exposed externally at floor levels resulting in a thermal bridge.

4 Junction of solid balcony floor and cavity wall with injected insulation resulting in a thermal bridge.

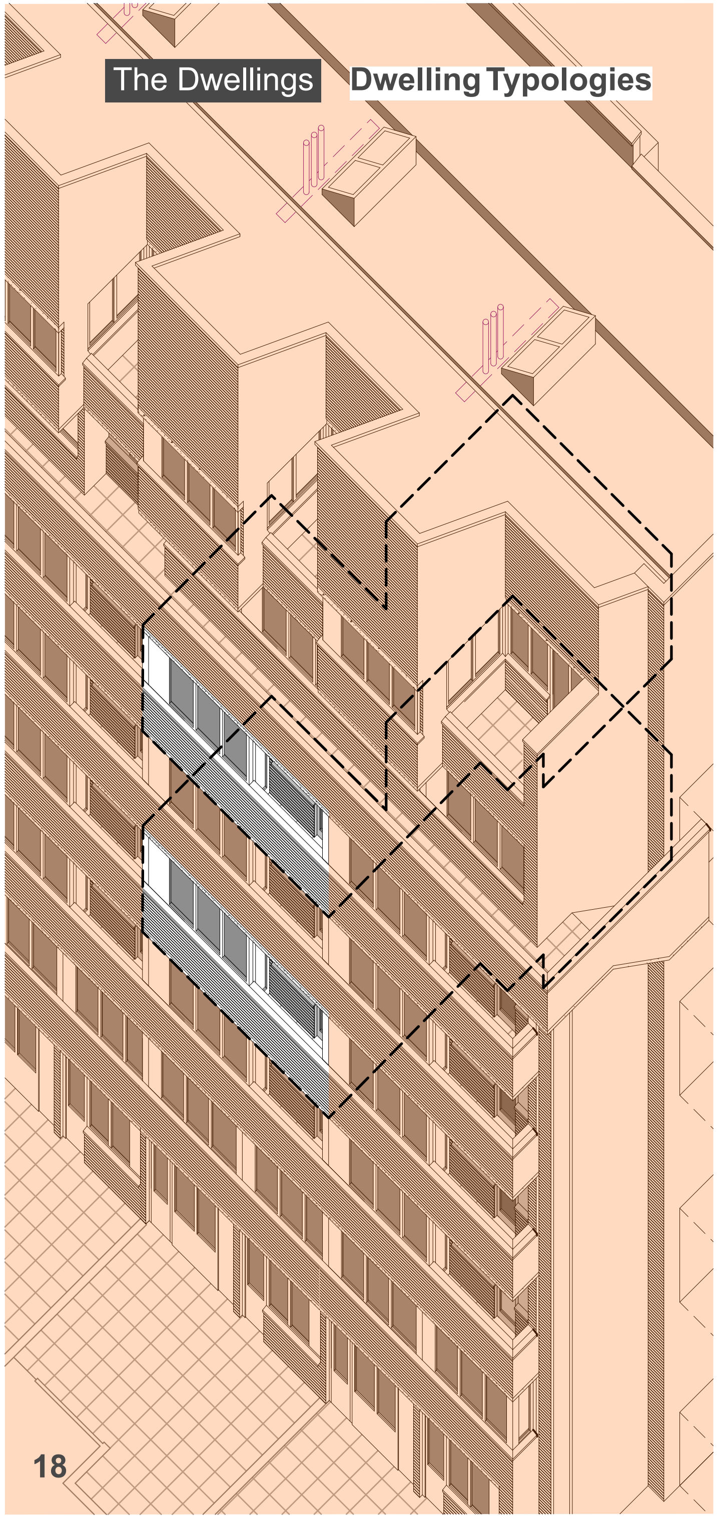
5 Window installation detail is unknown but may be a poor performing thermal bridge.

AIRTIGHTNESS

a Airtightness of cavity wall will depend on type, quality and continuity of masonry, injected cavity insulation and internal plaster.

b Airtightness of window unit and installation within cavity wall is unknown.

Construction composition and sizes are assumptions based on visual checks and archival research

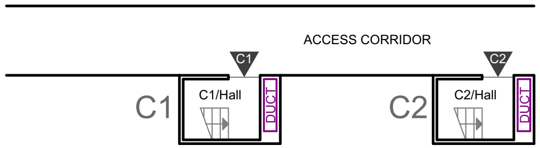


TYPE C

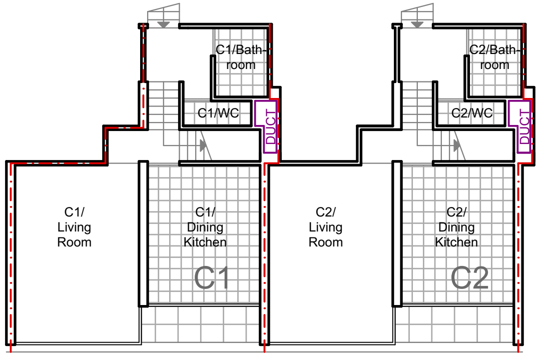
2-level 'Down' scissor flats

C1 - 3 Bedrooms
Second & Third Floor Dwellings 20/24/28/32 (4 no.) Access from Fourth Floor access corridor and hall
Fourth & Fifth Floor Dwellings 35/38/41/45 (4 no.) Access from Sixth Floor access corridor and hall
77sqm gross internal floor area, excluding balconies and access corridor storage.

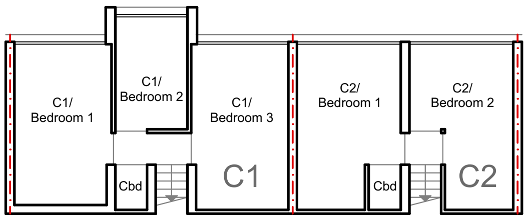
C2 - 2 Bedrooms
Second & Third Floor Dwellings 18/22/26/30 (4 no.) Access from Fourth Floor access corridor and hall
Fourth & Fifth Floor Dwellings 33/36/40/43 (4 no.) Access from Sixth Floor access corridor and hall
69sqm gross internal floor area, excluding balconies and access corridor storage.



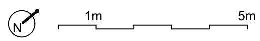
ACCESS CORRIDOR PLAN (1/2 LEVEL UP)



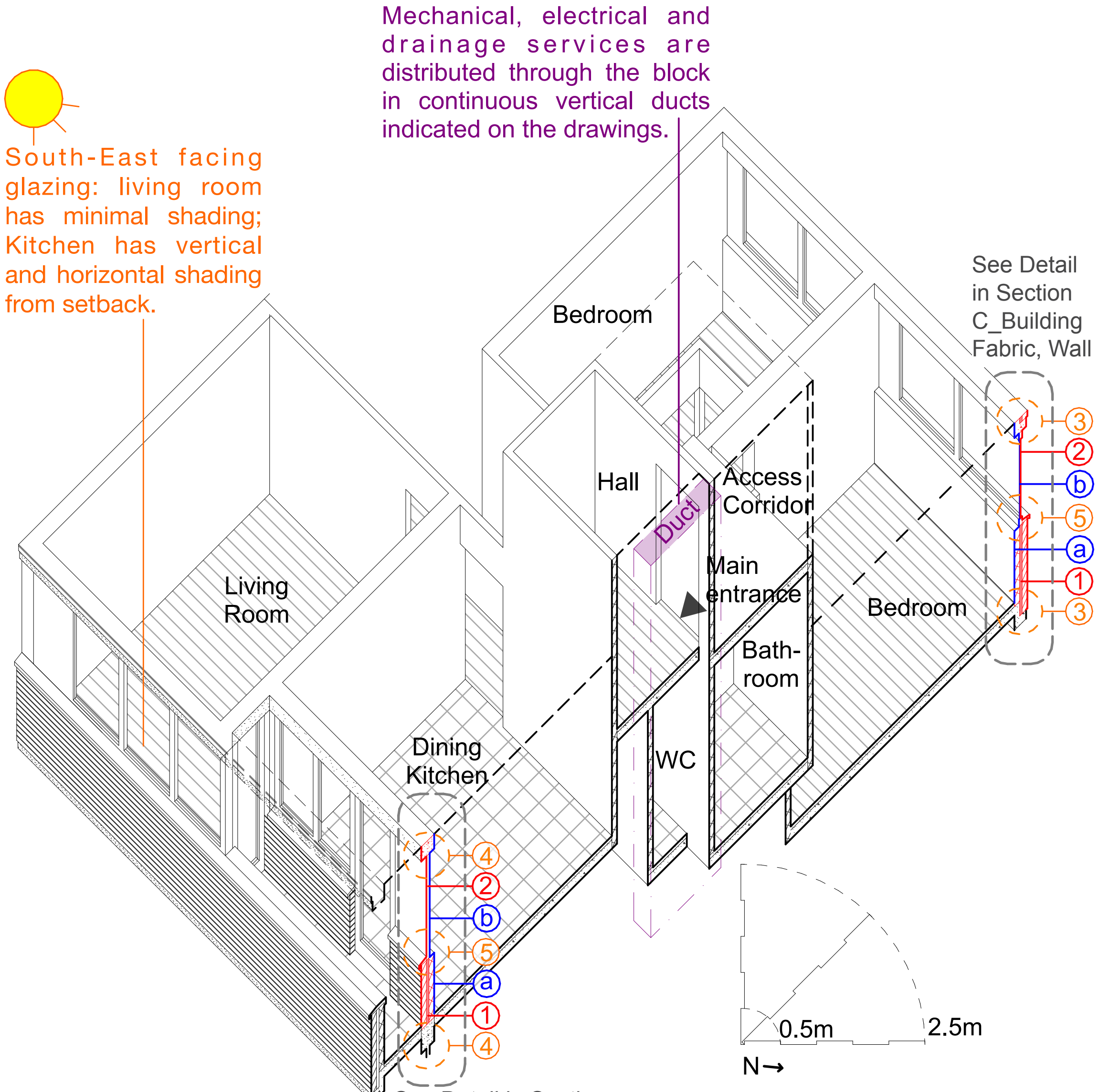
UPPER LEVEL PLAN



LOWER LEVEL PLAN



CROSS SECTION_1:200
A = Access Corridor



See Detail in Section C_Building Fabric, Walls; Windows

SECTION/AXONOMETRIC OF DWELLING_1:100

For an explanation of what is meant by the building envelope, thermal bridges and airtightness, see ‘Section C - Building Fabric’

BUILDING ENVELOPE

1 Cavity wall with facing brick outer leaf, 2" cavity, masonry inner leaf. Long-term residents recollect injected cavity insulation has been installed.

2 Non-original double-glazed PVCu windows, spandrel panels and doors. Site observation and resident comments, suggests some glazing units may be degraded.

THERMAL BRIDGES

3 Concrete structure exposed externally at floor levels resulting in a thermal bridge.

4 Junction of solid balcony floor and cavity wall with injected insulation resulting in a thermal bridge.

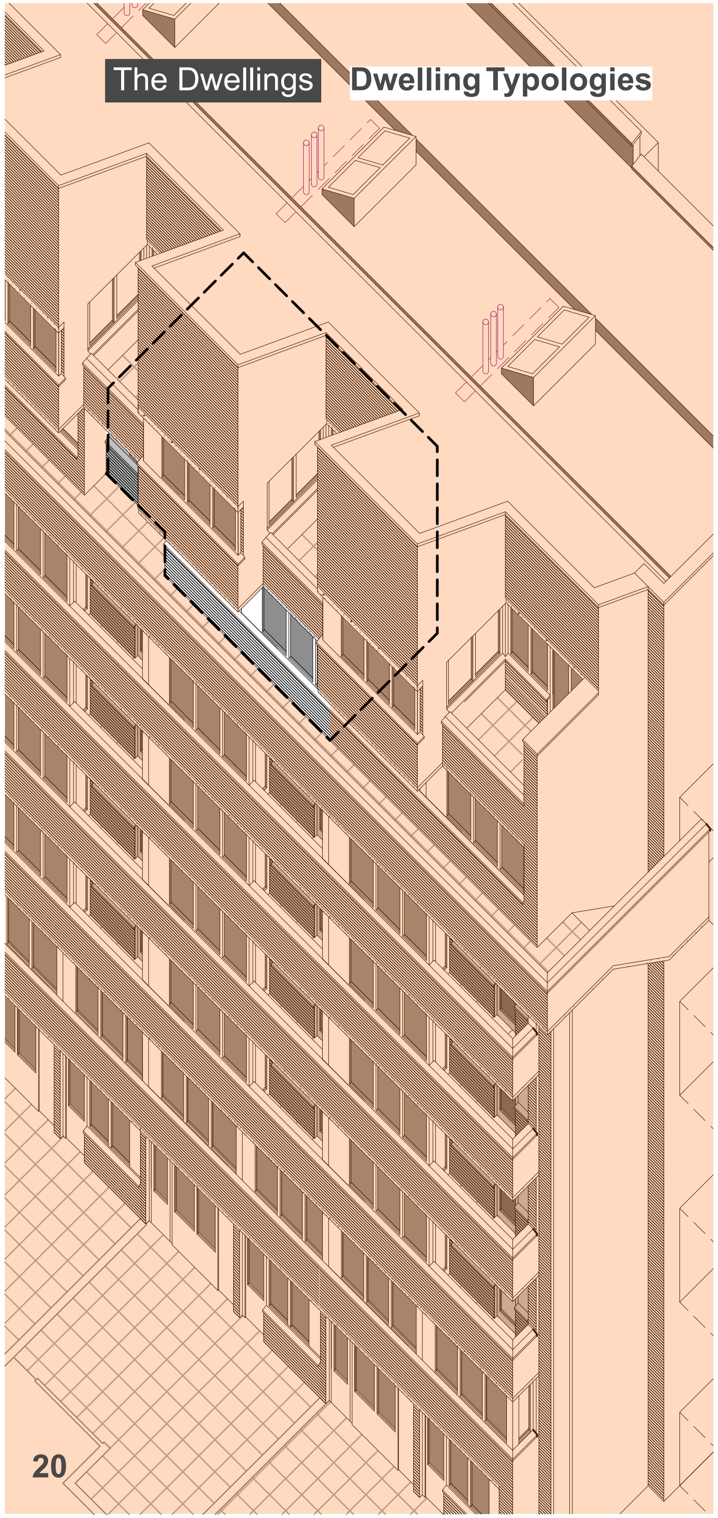
5 Window installation detail is unknown but may be a poor performing thermal bridge.

AIRTIGHTNESS

a Airtightness of cavity wall will depend on type, quality and continuity of masonry, injected cavity insulation and internal plaster.

b Airtightness of window unit and installation within cavity wall is unknown.

Construction composition and sizes are assumptions based on visual checks and archival research

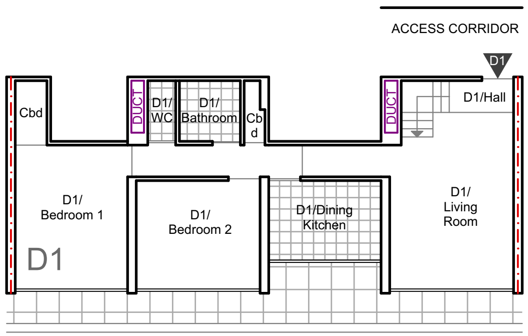


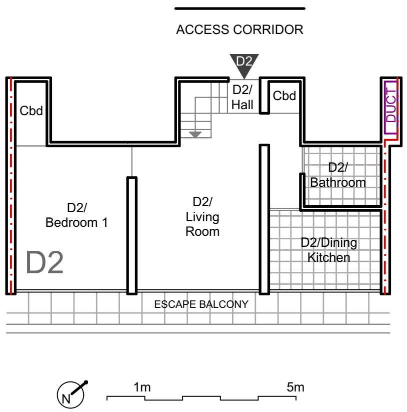
TYPE D

1-level Single Aspect Flat

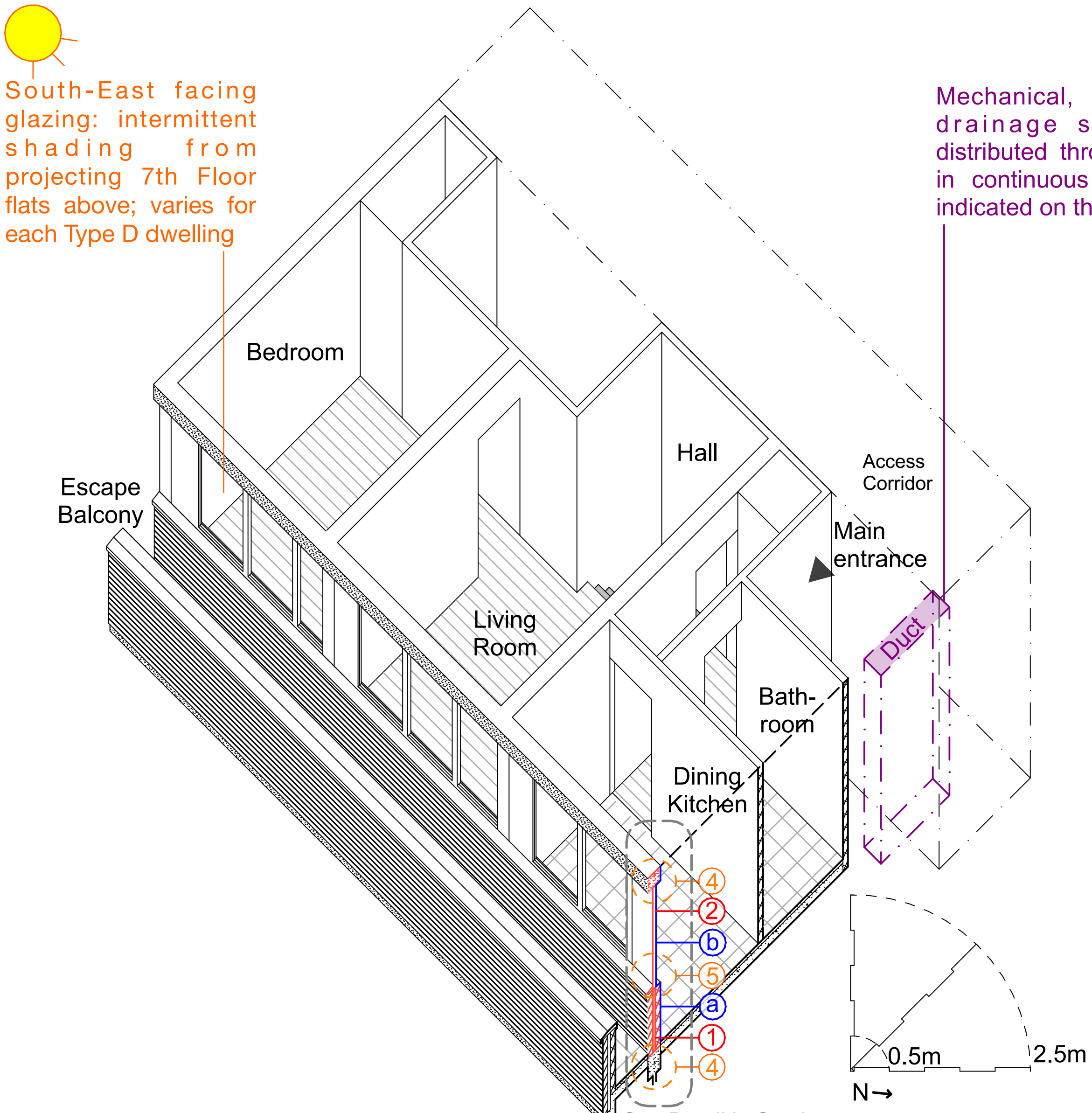
D1 - 2 Bedrooms
Sixth Floor Dwelling 37 (1 no.)
Access from Sixth Floor access corridor and hall
59sqm gross internal floor area, excluding balconies and access corridor storage.

D2 - 1 Bedroom
Sixth Floor Dwellings 34, 39, 42, 44 (4 no.) Access from Sixth Floor access corridor and hall
45sqm (average) gross internal floor area, excluding balconies and access corridor storage.
Layout and area varies for each type D2 dwelling, see survey plan for variations.





CROSS SECTION_1:200
A = Access Corridor



See Detail in Section C_Building Fabric, Walls; Windows

SECTION/AXONOMETRIC OF DWELLING_1:100

For an explanation of what is meant by the building envelope, thermal bridges and airtightness, see 'Section C - Building Fabric'

BUILDING ENVELOPE

1 Cavity wall with facing brick outer leaf, 2" cavity, masonry inner leaf. Long-term residents recollect injected cavity insulation has been installed.

2 Non-original double-glazed PVCu windows, spandrel panels and doors. Site observation and resident comments, suggests some glazing units may be degraded.

THERMAL BRIDGES

3 Concrete structure exposed externally at floor levels resulting in a thermal bridge.

4 Junction of solid balcony floor and cavity wall with injected insulation resulting in a thermal bridge.

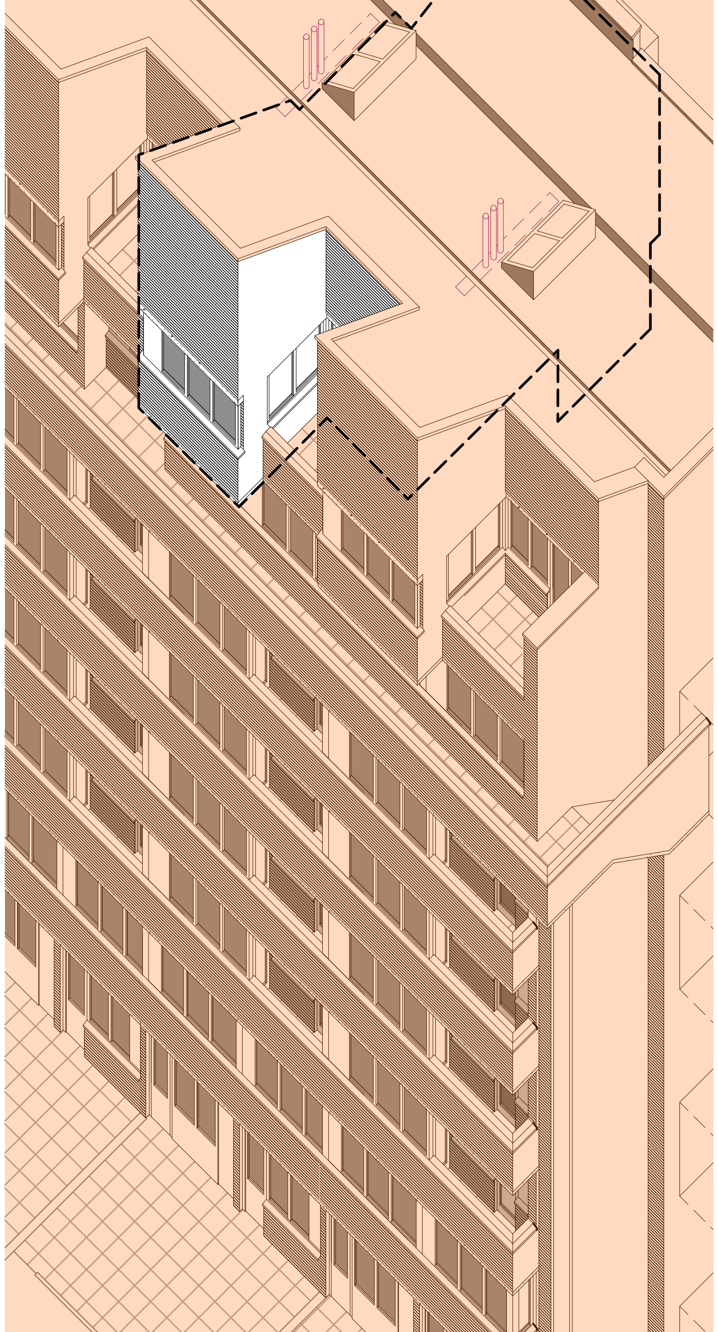
5 Window installation detail is unknown but may be a poor performing thermal bridge.

AIRTIGHTNESS

a Airtightness of cavity wall will depend on type, quality and continuity of masonry, injected cavity insulation and internal plaster.

b Airtightness of window unit and installation within cavity wall is unknown.

Construction composition and sizes are assumptions based on visual checks and archival research



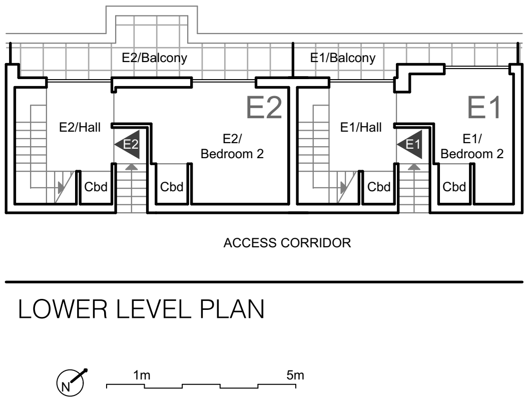
TYPE E

2-level Top Floor Maisonette

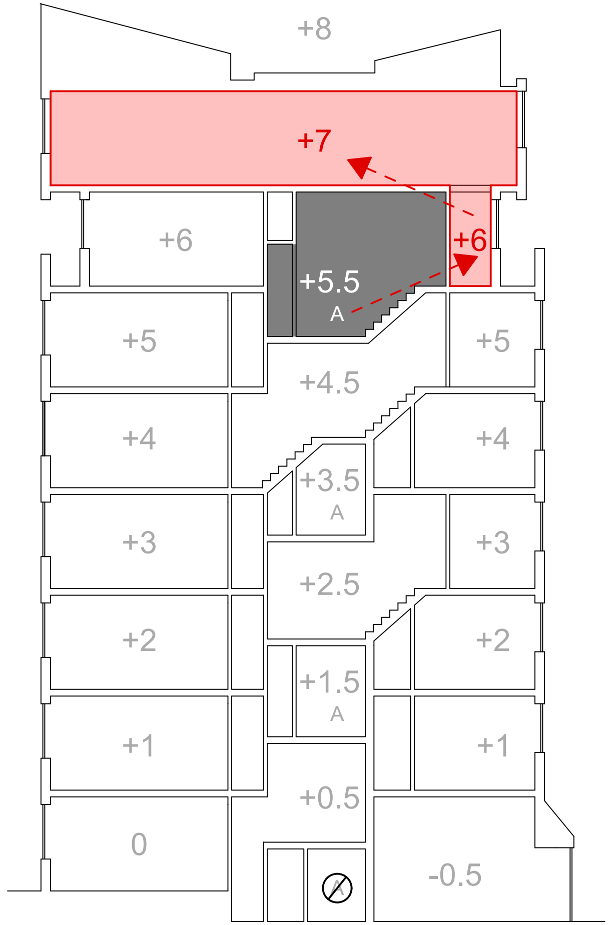
E1 - 3 Bedrooms (24ft wide)
Sixth & Seventh Floor Dwellings 47, 49, 51, 53 (4 no.)
Access via steps from Sixth Floor access corridor and hall
88sqm gross internal floor area, excluding balconies and access corridor storage.

E2 - 3 Bedrooms (20ft wide)
Sixth & Seventh Floor Dwellings 45, 47, 49, 51 (4 no.)
Access via steps from Sixth Floor access corridor and hall
83sqm gross internal floor area, excluding balconies and access corridor storage.

UPPER LEVEL PLAN

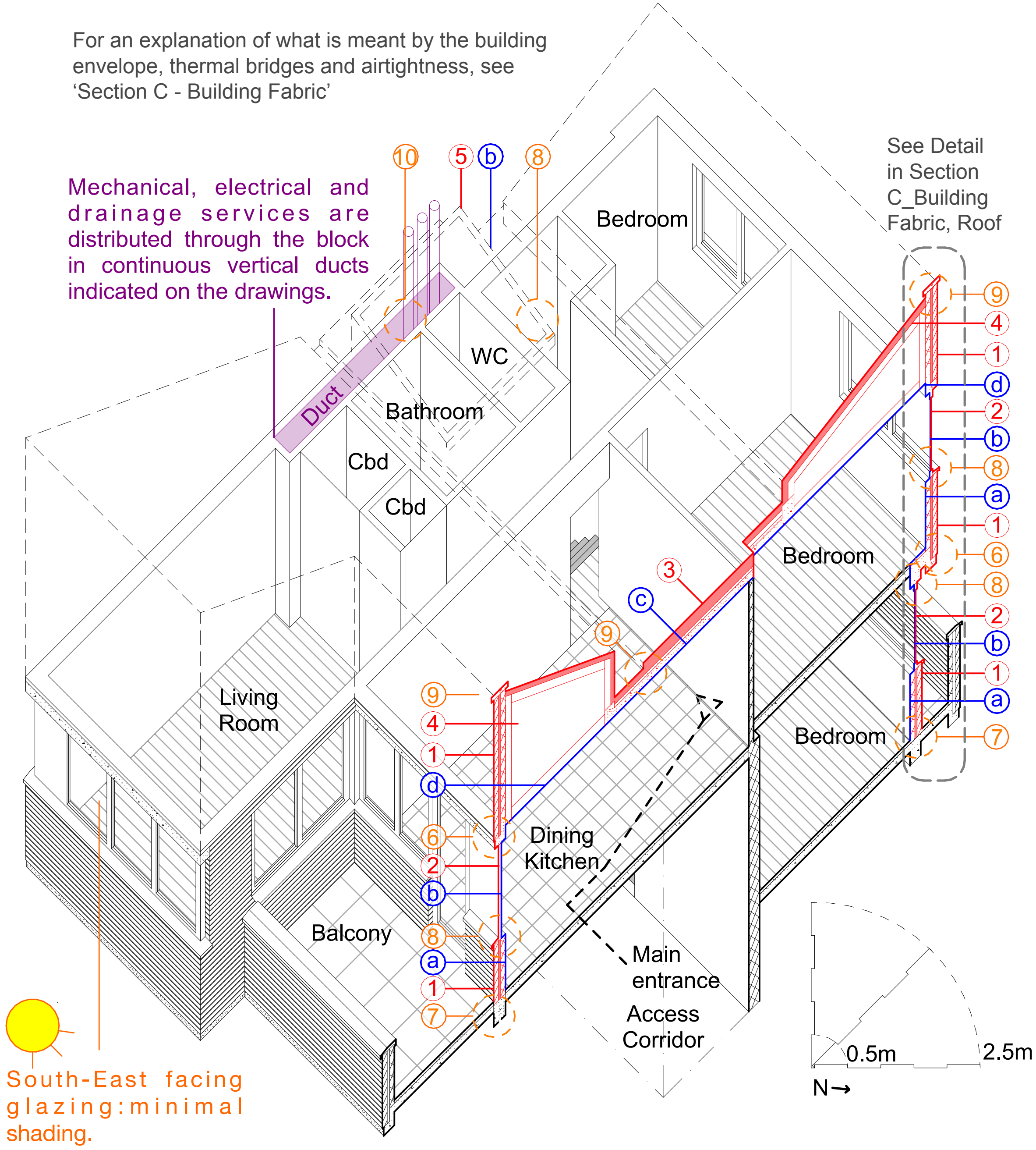


LOWER LEVEL PLAN



CROSS SECTION_1:200
A = Access Corridor

For an explanation of what is meant by the building envelope, thermal bridges and airtightness, see 'Section C - Building Fabric'



SECTION/AXONOMETRIC OF DWELLING_1:100

Construction composition and sizes are assumptions based on visual checks, archival research & Bauder roof survey (2024).

BUILDING ENVELOPE

1 Cavity wall with facing brick and 2" cavity. with historic injected cavity insulation.

2 Double-glazed PVCu windows and doors; some glazing units may be degraded.

3 Warm deck flat roof, 5" concrete slab with 2" screed, degraded 80mm PIR/Cork insulation with mastic asphalt waterproofing over.

4 Pitched roof, unknown substructure/roof truss. Warm roof mastic asphalt build-up similar to flat roof (3).

THERMAL BRIDGES

5 Single glazed rooflights over bathroom/WC.

6 Concrete structure exposed externally at floor levels resulting in a thermal bridge.

7 Junction of solid balcony floor and cavity wall with resulting in a thermal bridge.

8 Window and rooflight installation may be a poor performing thermal bridge.

9 Changes or interruptions in roof build-up and insulation thickness will result in thermal bridges, e.g. at valley gutter and upstands.

10 Soil vent and rainwater pipe penetrations through roof level resulting in thermal bridges.

AIRTIGHTNESS

a Airtightness of wall will depend on type, quality and continuity of masonry, injected cavity insulation (if present), internal plaster.

b Window/rooflight and installation within building envelope is unknown.

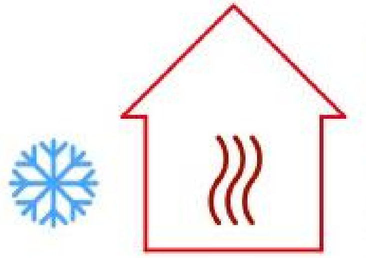
c 7" screed/concrete solid roof construction is likely to be intrinsically airtight.

d Pitched roof and roof void composition is unknown

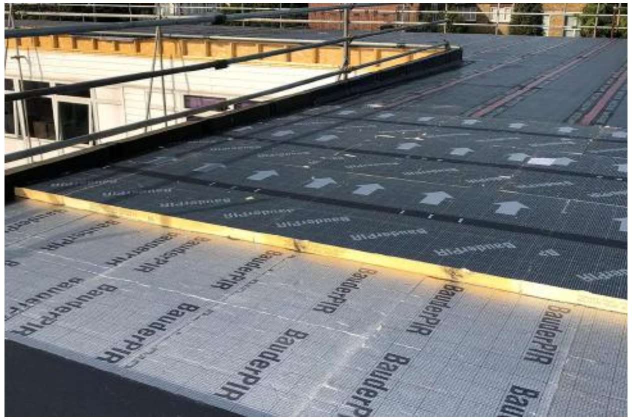
C
Building Fabric

1_Explainer

The Building Envelope

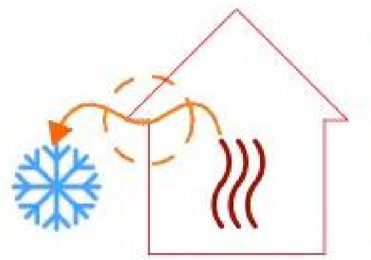


The building envelope consists of all components that separate the interior from the exterior. The interior of the building provides a comfortable climate, whereas the outside is determined by the weather. In order to maintain comfortable indoor conditions, the building envelope is insulated and prevented from air leakages.



Insulation laid over a flat roof forming part of the building envelope
(source: Bauder)

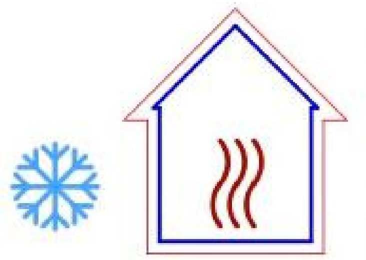
Thermal Bridges



Heat makes its way from the heated space towards the outside. In doing so, it follows the path of least resistance. A thermal bridge is a localised area of the building envelope where the heat flow is increased in comparison with adjacent areas. The effects of thermal bridges are heat loss, cold internal surfaces and in the worst case moisture penetration, condensation and mould growth.

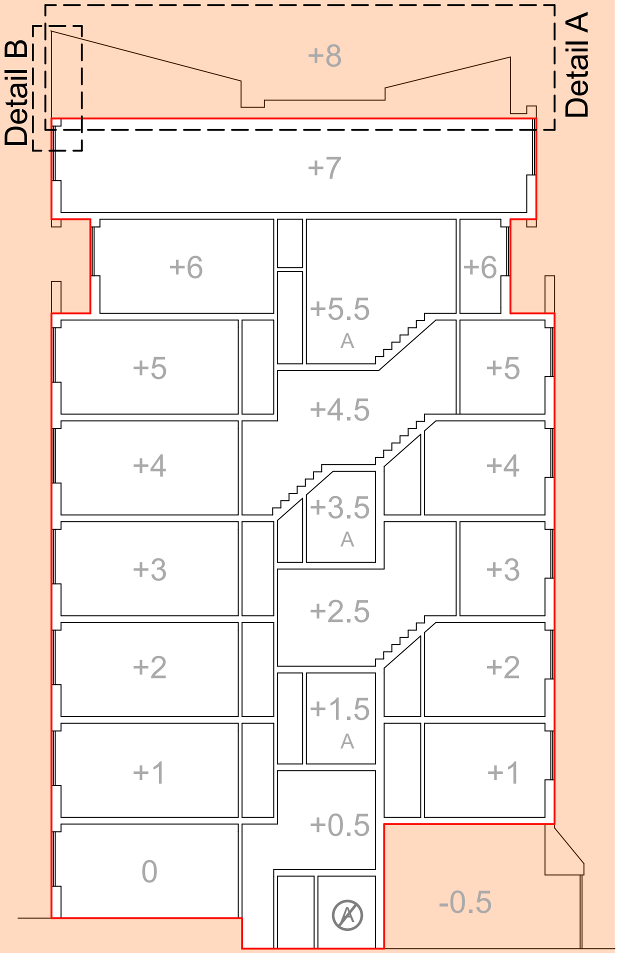
Part of the concrete structure at Bence House penetrating the building envelope over a window forming a localised 'cold' thermal bridge between the interior and exterior

Airtightness



In addition to insulating the building envelope there should also be an airtight layer. There are many disadvantages of air flowing in through joints and gaps in the building envelope. A large percentage of building damage is caused by leaks in the building envelope. Sound insulation is reduced, drafts cause discomfort for occupants and there are high heat losses.

Multiple potential air leakages through the roof of Bence House including service penetrations and defective single glazing in the rooflights.



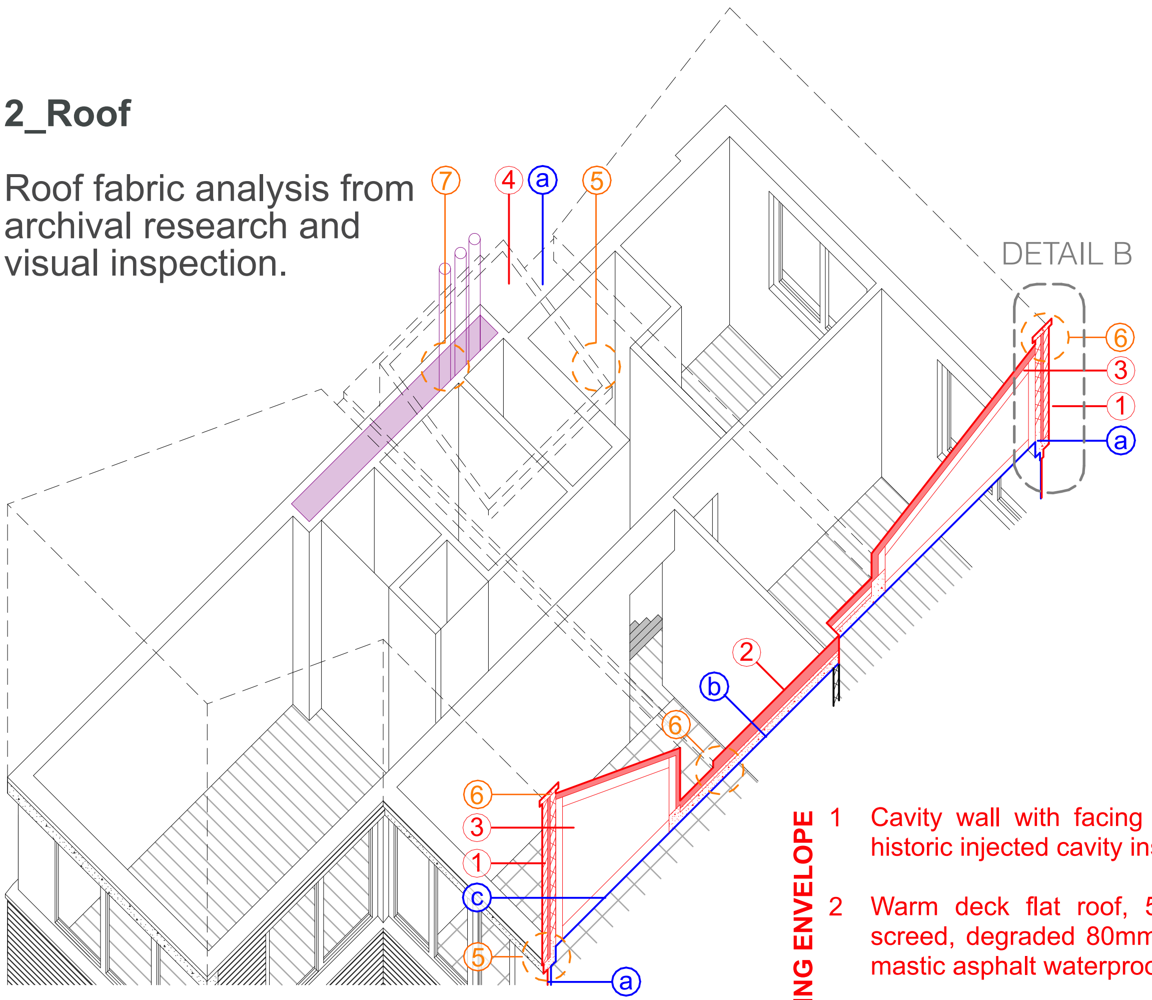
CROSS SECTION_1:200

A = Access Corridor

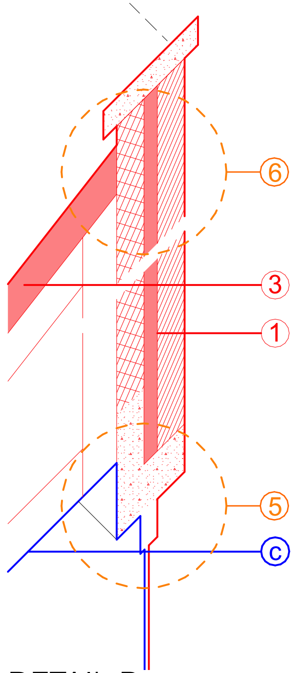
= Thermal Envelope

2_Roof

Roof fabric analysis from archival research and visual inspection.



DETAIL A
Main Roof Section
1:100



DETAIL B
Roof/Wall 1:20

KEY

AIRTIGHTNESS

- **a** Window/rooflight and installation within building envelope is unknown.
- **b** 7" screed/concrete solid roof construction is likely to be intrinsically airtight.
- **c** Pitched roof and roof void composition is unknown

BUILDING ENVELOPE

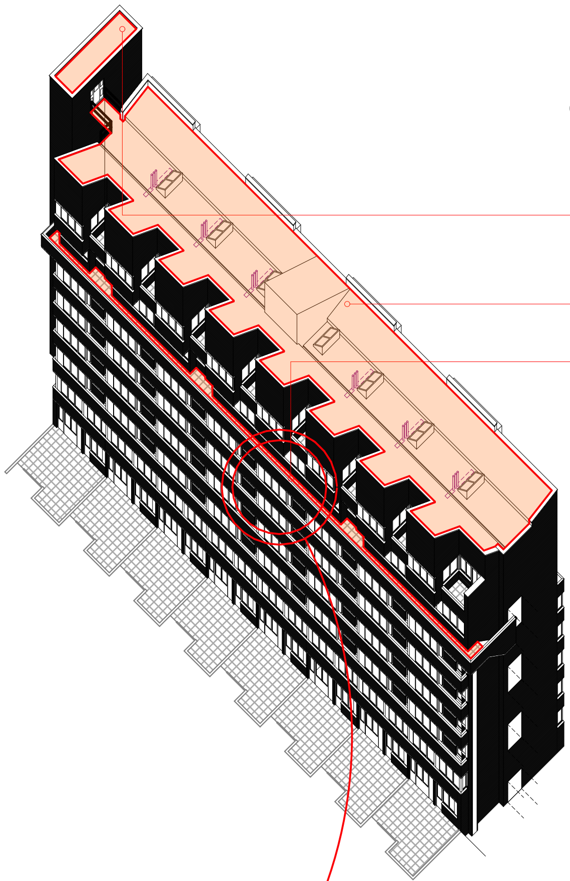
1. Cavity wall with facing brick and 2" cavity. with historic injected cavity insulation.
2. Warm deck flat roof, 5" concrete slab with 2" screed, degraded 80mm PIR/Cork insulation with mastic asphalt waterproofing over.
3. Pitched roof, unknown substructure/roof truss. Warm roof mastic asphalt build-up similar to flat roof (3).
4. Single glazed rooflights over bathroom/WC.

THERMAL BRIDGES

5. Window and rooflight installation may be a poor performing thermal bridge.
6. Changes or interruptions in roof build-up and insulation thickness will result in thermal bridges, e.g. at valley gutter and upstands.
7. Soil vent and rainwater pipe penetrations through roof level resulting in thermal bridges.

Roof surveys

Undertaken for this report including core sample analysis.



'Tank Room Roof' Survey Report

'Main Roof' Survey Report

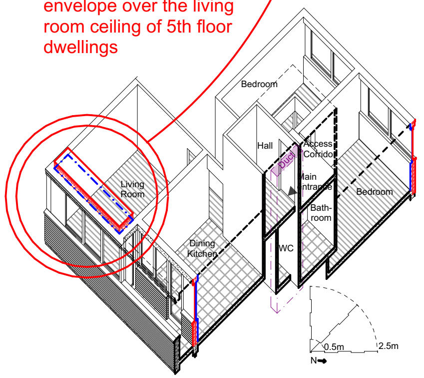
'Top Floor Walkway' Survey Report

Bauder are a leading manufacturer and roof experts for commercial flat roof systems in the UK. Bauder has a positive working relationship with Lewisham Council and were recommended to provide guidance for this report.

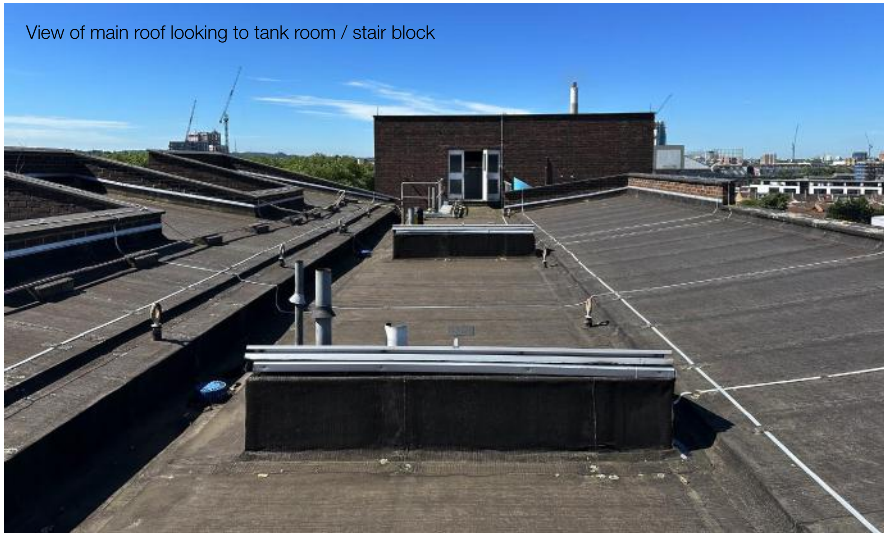
Roof Survey Reports_20.06.24
Commissioned for this study
Project Reference: B242402/1

Bauder Surveys and Proposals collated in Appendix 3 of this report

The 6th floor walkway/ escape balcony roof forms part of building envelope over the living room ceiling of 5th floor dwellings



Black mould on living room ceiling under area of communal roof of 6th floor escape balcony



View of main roof looking to tank room / stair block

Key Findings from Roof Survey

Construction from core sample analysis

Construction Type:	Warm Roof
Waterproofing:	Two layer bituminous membrane system
Insulation:	80mm Cork/PIR composite board *

* Insulation is dry but degraded

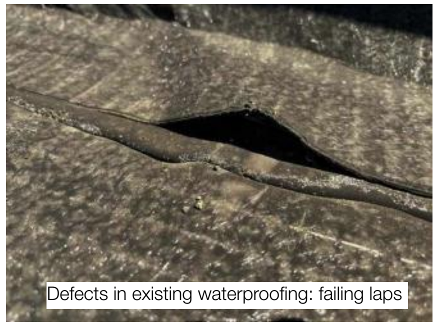
Vapour Control Layer:	Bituminous membrane vapour control layer
Waterproofing:	Mastic Asphalt
Screed:	Lightweight Cementitious Screed
Roof Deck:	Concrete *

* The decking is believed to be in a good condition and of a suitable construction type to be reused as part of the roof refurbishment.

Issues & considerations with existing waterproofing

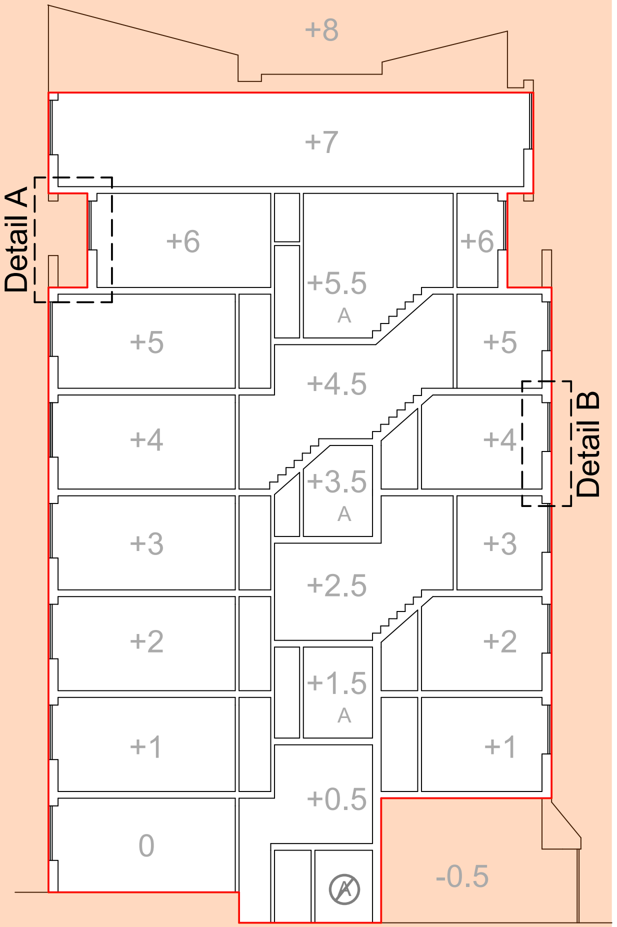
- The typical condition of the membrane has delaminated and oxidised indicating that the system is nearing the end of its life.
- Failing of laps that could allow water into the existing system
- Holes in the membrane allowing water into the system and damaging the insulation's thermal efficiency.

Core sample showing roof construction



Defects in existing waterproofing: failing laps

Building Fabric **Walls**

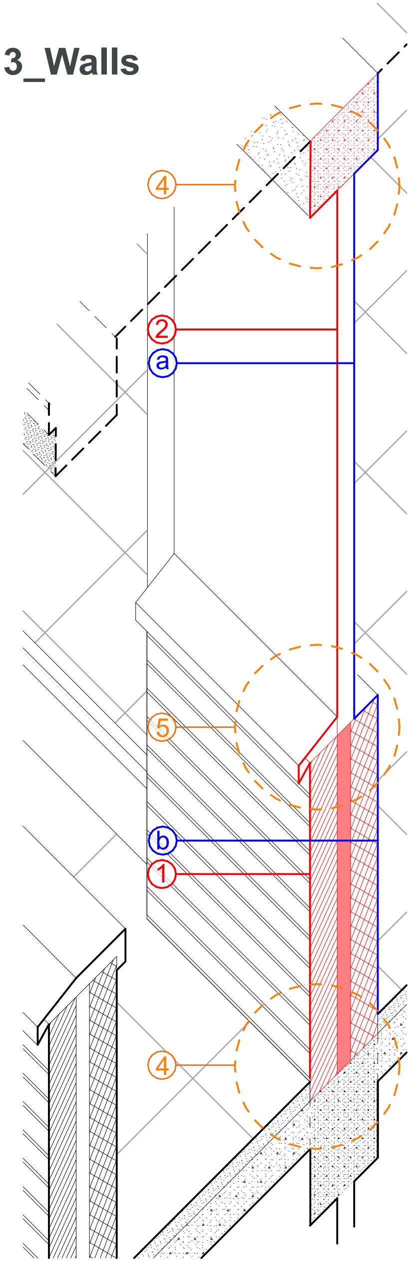


CROSS SECTION_1:200

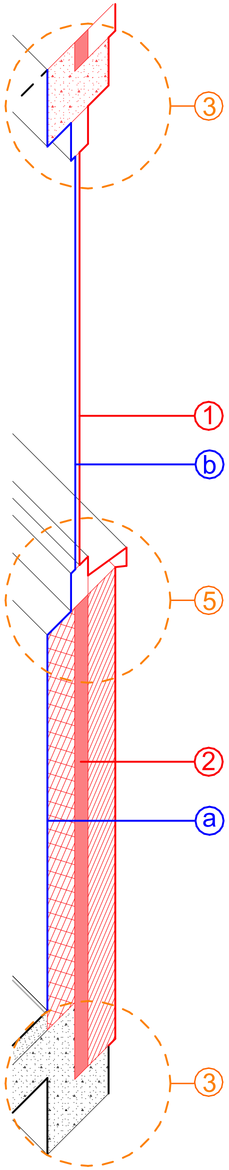
A = Access Corridor

= Thermal Envelope

3_Walls



DETAIL A
Cavity Wall @ Balcony
1:20



DETAIL B
Cavity Wall @ Elevation
1:20

KEY

BUILDING ENVELOPE

1 Cavity wall with facing brick outer leaf, 2" cavity, masonry inner leaf. Long-term residents recollect injected cavity insulation has been installed.

2 Non-original double-glazed PVCu windows, spandrel panels and doors. Site observation and resident comments, suggests some glazing units may be degraded.

THERMAL BRIDGES

3 Concrete structure exposed externally at floor levels resulting in a thermal bridge.

4 Junction of solid balcony floor and cavity wall with injected insulation resulting in a thermal bridge.

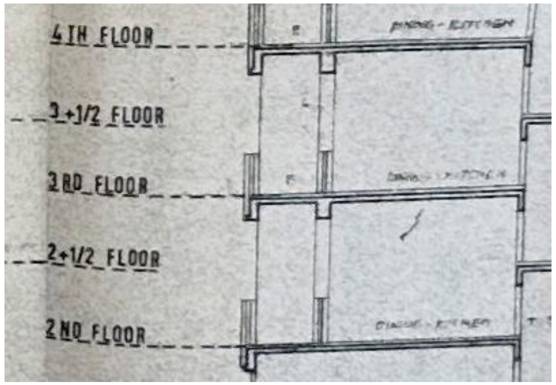
5 Window installation detail is unknown but may be a poor performing thermal bridge.

AIRTIGHTNESS

a Airtightness of cavity wall will depend on type, quality and continuity of masonry, injected cavity insulation and internal plaster.

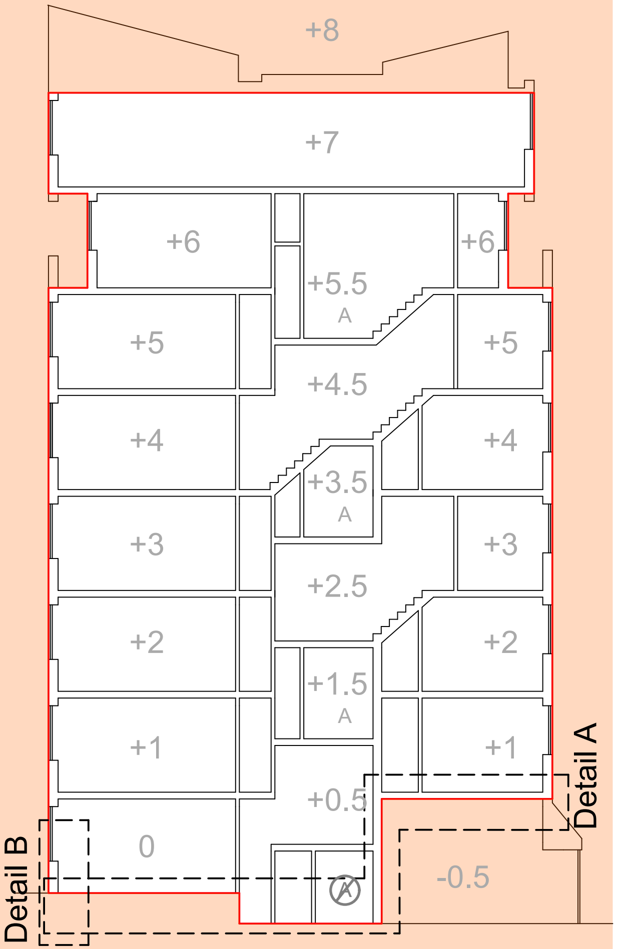
b Airtightness of window unit and installation within cavity wall is unknown.

Construction composition and sizes are assumptions based on visual checks and archival research



Detail of archival section showing concrete frame and cavity wall construction

4_Floor



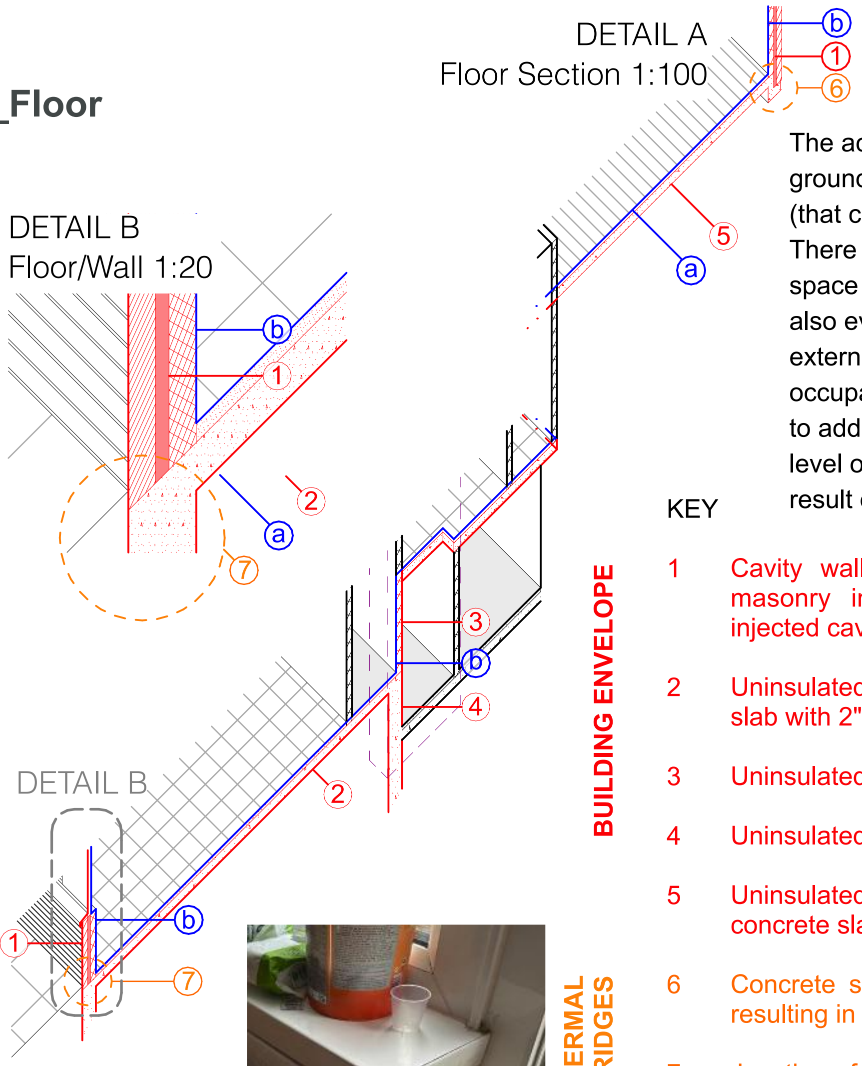
CROSS SECTION_1:200

A = Access Corridor

☐ = Thermal Envelope

DETAIL A
Floor Section 1:100

DETAIL B
Floor/Wall 1:20



The access to the original entrance from the ground floor access corridor has been blocked off (that corridor is now inaccessible externally). There is evidence of damp ingress from this space within the ground floor dwellings. There is also evidence of a cold thermal bridge along the external wall/floor junction, in one instance the occupant has applied DIY internal wall insulation to address this. Cold floor surfaces on the lower level of the ground floor flats, assumed to be the result of uninsulated solid construction.

KEY

BUILDING ENVELOPE

1 Cavity wall with facing brick outer leaf, 2" cavity, masonry inner leaf. Long-term residents recollect injected cavity insulation has been installed.

2 Uninsulated ground-bearing solid floor, 5" concrete slab with 2" screed over.

3 Uninsulated 9" masonry wall to unheated spaces.

4 Uninsulated solid retaining wall.

5 Uninsulated solid floor over unheated spaces, 5" concrete slab with 2" screed over.

THERMAL BRIDGES

6 Concrete structure exposed externally at floor levels resulting in a thermal bridge.

7 Junction of solid floor slab and cavity wall with injected insulation resulting in a thermal bridge.

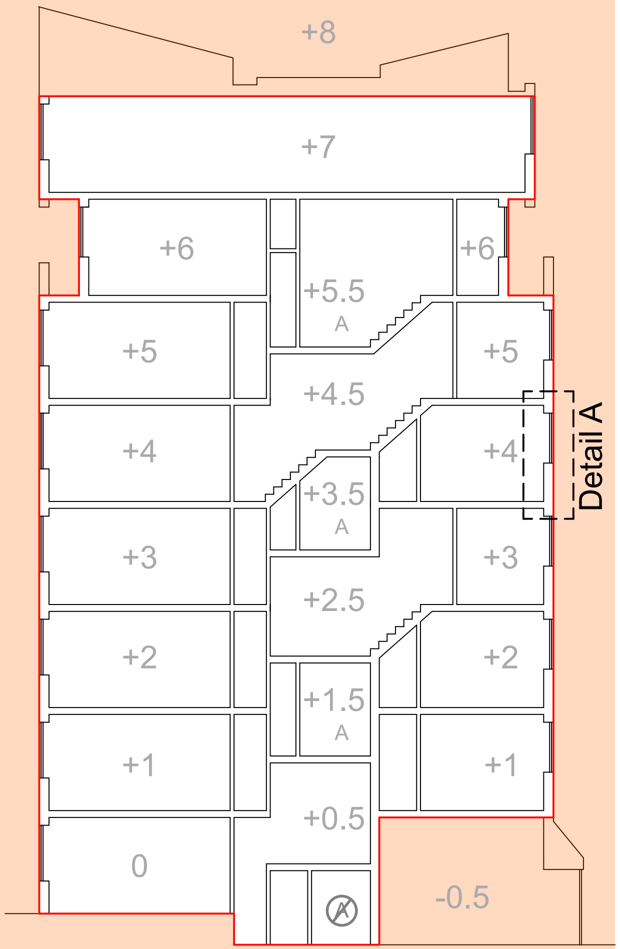
AIRTIGHTNESS

a 7" screed/concrete solid floor construction is likely to be intrinsically airtight.

b Airtightness of wall will depend on type, quality and continuity of masonry, injected cavity insulation (if present), internal plaster.

Construction composition and sizes are assumptions based on visual checks and archival research

DIY internal insulation to address thermal discomfort in winter

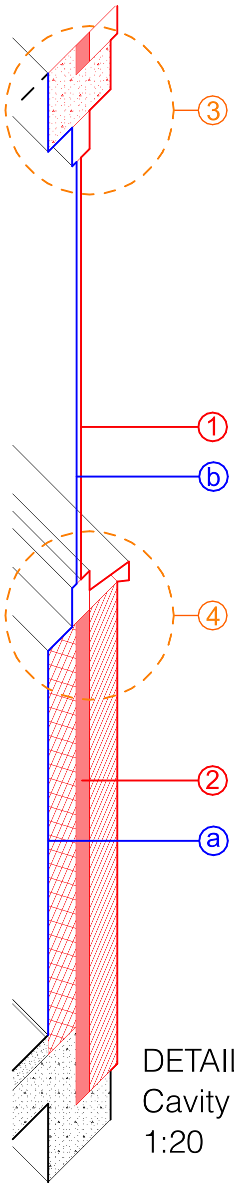


CROSS SECTION_1:200

A = Access Corridor

= Thermal Envelope

5_Windows & Doors



DETAIL A
Cavity Wall @ Balcony
1:20

KEY

BUILDING ENVELOPE

1 Cavity wall with facing brick outer leaf, 2" cavity, masonry inner leaf. Long-term residents recollect injected cavity insulation has been installed.

2 Non-original double-glazed PVCu windows, spandrel panels and doors. Site observation and resident comments, suggests some glazing units may be degraded.

THERMAL BRIDGES

3 Concrete structure exposed externally at floor levels resulting in a thermal bridge.

4 Window installation detail is unknown but may be a poor performing thermal bridge.

AIRTIGHTNESS

a Airtightness of cavity wall will depend on type, quality and continuity of masonry, injected cavity insulation and internal plaster.

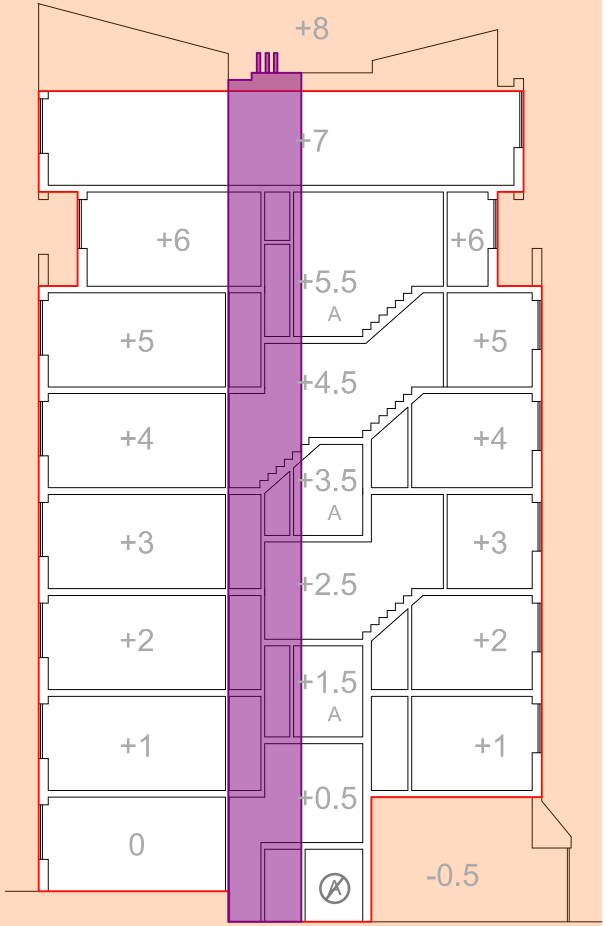
b Airtightness of window unit and installation within cavity wall is unknown.

Construction composition and sizes are assumptions based on visual checks and archival research

Some occupants reported issues with degraded double glazing and condensation forming between glass layers. We were unable to observe the extent of the problem as our inspection was undertaken on a warm day. There are trickle vents on the PVCu windows enabling background ventilation. See Section D1 for an explanation of ventilation within the dwellings.

Bedroom elevation windows

6_Ducts



CROSS SECTION_1:200

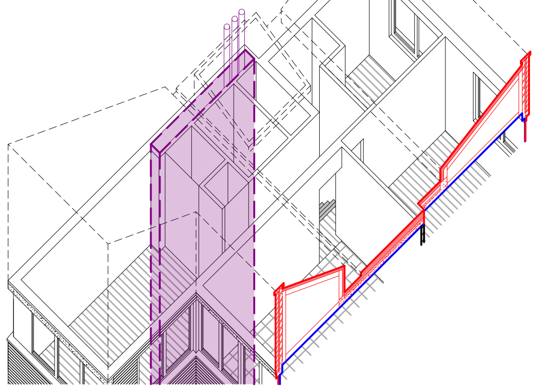
A = Access Corridor

= Thermal Envelope

= Service Riser / Duct

Intermediary floor plan with main vertical service ducts 1:500

Main Duct @ Roof 1:200



There are 9 vertical service risers running from ground to roof level, varying in width within each floor, that should be considered part of the building envelope in terms of heat loss and airtightness, similar to a chimney in a traditional home. The management and maintenance of the ducts will also have an impact on fire safety. The risers are located at the separating wall between dwellings, typically between the entrance lobby and WC/bathroom of the adjacent dwelling. The primary services running within the risers are waste pipes that connect below ground drainage to soil vent pipes at roof level, and to rainwater outlets at roof level. Other services are also present but may be defunct, such as historic district heating and hot water pipework; longstanding residents advise this connected to a fan coil unit providing hot air to the living spaces.

There is a longstanding and ongoing problem with copper pipework, within the vertical risers and within dwellings. Multiple cases of burst copper pipes were observed for this reports with water damage visible in several dwellings, typically repairs are made with flexible plastic pipework where the damage was visible behind access panels. The condition of the service riser cover panels is poor in some dwellings, possibly as a result of the water damage. This may compromise the integrity of the fire-rating and airtightness if the panel is loose and not well-fitted. Several occupants have seen mice in the riser.

Service riser in entrance lobby with repaired burst copper waste pipe and defunct district heating pipework

7_Recommendations

These recommendations are intended to complement (not replace) the data gathering and deep assessment of Bence House dwellings as part of a PAS2035 compliant retrofit process, described in the introduction.

Roof

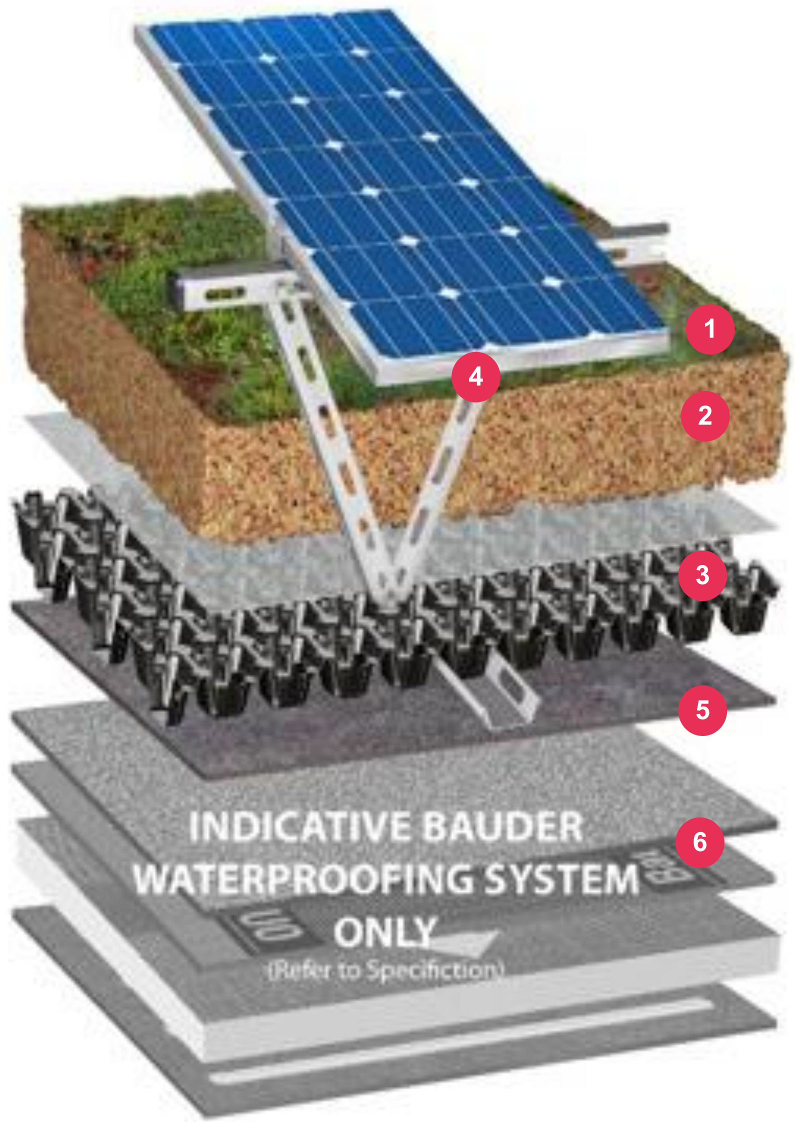
Please refer to the Bauder Roof Reports commissioned for this study (Supplementary Material - 3) for full details of the investigation and proposed specification. An outline of the proposal for the main roof can be summarised as follows:

- Reuse Existing Deck: The current deck appears to be in good condition.
- Remove and Replace Waterproofing: The existing waterproofing system is to be completely removed and replaced due to its poor condition.
- Upgrade Insulation: The insulation is degraded and is to be replaced, to comply with current Energy Conservation Regulations, improving thermal performance.
- Address Standing Water: Tapered Insulation will be used to create a minimum fall of 1:80 in gutter channels to alleviate standing water.
- Install New Outlets: New rainwater outlets will be installed, compatible with the new waterproofing system and existing drainage pipework.
- Raise Waterproofing Upstand: The waterproofing upstand will be raised to a minimum height of 150mm, with counter-flashings positioned accordingly.
- Modify Access Door: The existing door (from stair block) will be replaced to raise the upstand kerb for re-waterproofing.
- Replace Rooflights: Existing rooflights will be replaced, with specific requirements identified for individual units.
- Install Guard Rail System: A new free-standing guard rail system will be installed to ensure safe access and egress, with specialist advice recommended for specification.

These proposals aim to improve the roof’s thermal performance, drainage, and safety while ensuring compliance with relevant standards and regulations.

Through a coordinated design and procurement of the roof renovation other opportunities can be considered. Consequently, Bauder has prepared a specification to:

- Incorporate a Green Roof: Installing a green roof over the renovated roof can improve air quality, reduce storm water runoff, and promote biodiversity.
- Incorporate Renewable Energy Generation: Installing Solar Photovoltaic modules can reduce fuel bills, reduce carbon footprint and sell energy back to the grid.



Bauder Biosolar Roof Specification

The Bauder Biosolar system is an integrated solution for mounting photovoltaic renewable energy on a green roof where the substrate and vegetation provide the ballasted installation mechanism to secure the array. The system is suitable for retrofit projects. This system allows for the entire roof area to qualify as a green roof, and if a biodiversity vegetation finish is elected for, this can further enhance the roof's environmental credentials.

1. A range of UK provenance seed mixes for green roof
2. Biodiverse substrate providing a free draining, growing medium for green roof systems.
3. Filtration layer that prevents substrate fines from washing into the drainage and water storage layer.
4. Photovoltaic mounting system. The anchor board is directly infilled with biodiverse substrate.
5. Protection layer to prevent mechanical damage to the underlying waterproofing.
6. Complete Bitumen Membrane waterproofing system suitable for biosolar build-up including insulation, airtightness and vapour control to project's performance requirements.

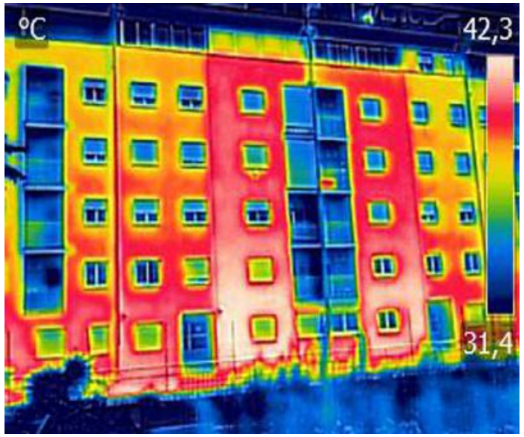
Walls

The construction of this block type is a concrete structural frame supporting masonry cavity walls forming the building envelope. The major unknown is the cavity itself, specifically what insulation it contains and other aspects of its condition such as wall ties that connect the inner and outer layers of masonry. An experienced Retrofit Assessor with good knowledge of cavity wall construction should be commissioned as part of a deep retrofit assessment. It is likely that certain techniques can be utilised to better understand the cavity wall construction:

- Borescope: Borescope inspections are used for visual inspection work where the target area, in this case the wall cavity, is inaccessible by other means, or where physical accessibility is precluded by disruption and expense. This allows for comprehensive examinations of a cavity without the need to open up large holes or remove brickwork from the façade.
- Thermography: Thermographic imagery is a technique that uses infrared radiation to create images that show heat distribution over the surface of an object. Retrofit assessors use thermography to detect heat loss and also air leakage in buildings. In this case, thermography can help determine if wall insulation is missing or degraded.
- Blower Door Test: A diagnostic method that measures how much air is entering or escaping a property to assess a building's airtightness.

This information will be necessary for the Retrofit Coordinator and Designer to develop a suitable strategy for energy efficiency improvements including understanding the risks and opportunities for different measures.

An example of a borescope image taken as part of a retrofit assessment of a property with cavity wall construction, in this case showing the wall ties and that there is no insulation present within the wall cavity.



An example of a thermographic imagery of a building showing heat distribution across a façade. Note the impact of thermal bridges around window openings and balconies.

In a Blower Door airtightness test, a powerful fan is mounted to the front door of the property to create negative pressure inside the home. This causes air to flow in through any gaps, cracks, or openings.

Floor

The existing solid floor construction is assumed to be uninsulated screed and concrete. This will result in an uncomfortable cold radiant surface. Equally, the installation of rigid insulation over an existing solid floor is disruptive, costly, and may also create issues with ceiling heights and floor levels. There is value in exploring measures to mitigate the thermal bridge of the wall/floor junction in the kitchens of Type A ground floor flats. The upper level of the Type A ground floor flats is over the garages. Again, this is a solid uninsulated floor but insulating the underside of this floor slab within the garages will be more straightforward if access can be arranged.

Windows & Doors

The Retrofit Assessor should advise on the performance, in terms of heat loss, solar gain, and airtightness, of the windows and doors. Several residents have reported defects with the glazing so the assessment should also consider the condition of the units and when they are likely to need replacement. Again, thermography and airtightness testing will help with this analysis.

Ducts

The vertical service ducts that run from ground floor to the roof are a neglected part of the block. The main concerns voiced by residents are that the ducts are a source of pipe leaks and vermin. There may also be performance considerations with respect to the spread of fire, airtightness and heat loss. Equally, the ducts provide opportunity for distributing new services. These are important building elements that need to be carefully considered in the retrofit process going forward.

A garage interior with the solid floor slab of a Type A unit above (upper level bedrooms). There is an opportunity to consider insulating this floor slab from below.

Typical windows and solid spandrel panel, in this case within the living room of a Type B scissor flat. The windows are non-original, PVCu, double glazed units with trickle vents.

A service duct within a Type B scissor flat WC containing numerous active services (including water and waste pipes) and defunct services (including district hot water and ventilation).

D
Building Services

1_Ventilation

Historically, there is evidence of a block-wide ventilation system with a rooftop fan house and ducting to each dwelling likely connected to heated fan-coil units providing some heated air to the living rooms in the dwellings. However the centralised ventilation system has long since been stripped out and the ventilation for each dwelling is now self-contained. This assessment is based upon home inspections carried out for this study. The primary finding is that the type and quality of the ventilation installation varies considerably from flat to flat. Equally, we did observe some important differences in the ventilation installed and managed by Lewisham Council for council tenants and the installation found in some leasehold properties.

How MVHR works:
- = fresh air gathered
- = outdoor air warmed & introduced
- = warm, stale air extracted
- = stale air cooled & exhausted

Mechanical Ventilation with Heat Recovery (MVHR)

Typically, it was observed that council tenant flats (and some leaseholder flats), had a mechanical ventilation system covering the whole dwelling installed by Lewisham Council in the last 20-30 years. The installation has a centralised air-handling unit gathering fresh outdoor air and exhausting stale air to the outside. These air handling units include a heat exchanger that transfers warmth from extracted air to fresh air entering the dwelling: a system called Mechanical Ventilation with Heat Recovery (MVHR). MVHR manages the distribution (through internal air ducts) of warmed air to living spaces and bedrooms and extracted stale air from bathrooms and kitchens. MVHR units are fitted with air filters to protect the heat exchanger and improve indoor air quality. When correctly installed and maintained, MVHR reduces the need to open windows, so is an attractive option for urban settings where noise and pollution are considerations.

Examples of MVHR installations in Bence House: (left) In the kitchen service riser within a Type A maisonette; (right) In the WC service riser within a Type B scissor flat.

MVHR is a good solution for ventilating airtight buildings (see Building Fabric - Section C), but as with any service that operates across a whole dwelling, such as a heating system, it is essential that it is competently designed, installed, commissioned, and maintained. During the home visits we observed numerous concerning issues with the MVHR systems as installed, with evidence suggesting that:

- Several MVHR units are inaccessible for inspection and maintenance, likely within boarded up service rises.
- MVHR units are turned off by the occupants, or simply not functioning, essentially leaving the property without sufficient ventilation. In one case there was significant condensation and mould within a property with a non-functioning MVHR installation.
- MVHR air filters have not been changed for many years, likely resulting in poor indoor air quality. In only one case did the occupant periodically remove and clean (but not replace) the air filters.
- In one home, a kitchen hood seems to have been connected to the MVHR system which can clog up the unit with cooking grease etc. and detrimentally impact indoor air quality. Black discharge can be seen around the supply air registers in the bedrooms.
- Poorly installed internal air ducting that is fragile, hard to clean, and poor performing.
- Poorly installed outdoor air vents where supply and exhaust air registers are too close which can result in stale air being drawn back into the property.
- Residents are not well informed on how the ventilation system should be used, managed or maintained.
- Windows have been supplied with trickle vents which is not required if the background ventilation is provided by the MVHR units.

No Ventilation

Typically, it was observed that whilst leasehold flats historically had an MVHR system installed by Lewisham Council in the 1990s/2000s, many leaseholders have since opted to strip this out. The reasons for removal of the ventilation system included: the ducts became a home for vermin, the system did not work, the duct enclosures were unsightly. Equally, in the cases observed for this report, no viable alternative ventilation system has been installed following the removal of the MVHR. This is a particular challenge given that most homes have bathrooms with no external wall or window. Consequently, there are several properties relying on leaving windows open in the living spaces to provide sufficient ventilation which can lead to high heat loss in winter, high fuel costs, overheating in summer and issues with noise and indoor air quality. Equally, it should be noted that many dwellings with non-functioning MVHR installations are in the same situation.

Example of a home where the MVHR ventilation system has been stripped out, with ductwork routes still visible but no replacement ventilation system has been installed.

(above left) A kitchen extractor connected to an MVHR system and (above right) a supply air register in the same property with black discharge.

(above left) Evidence of condensation and moisture damage within the bathroom of a property with a non-functioning MVHR installation; (above right) Intake and exhaust MVHR vents situated too close together in an external wall.

(above) Upper level floor plan & (below) lower level floor plan of adjacent Type A scissor flats.

Ventilation: Comparative Study

The variation of ventilation installations in Bence House can be seen starkly with this pair of Type A scissor flats that are located next door to one another. Both were visited in early summer 2024.

In one flat, there is a functioning MVHR system installed by the local authority in 1997. There are flaws with the installation however the occupant has knowledge of how to operate and maintain it and they report that it is still functioning to their satisfaction; the window trickle vents are permanently closed. During the home inspection, it was notable that the windows were closed whilst the indoor environment was a comfortable temperature, quiet and the occupant believed the indoor air quality was good. The occupant reported good heating levels and low fuel costs in winter, and no issues with overheating in summer.

Conversely, the adjacent property has no mechanical extract ventilation from either the kitchen, WC or bathroom. Consequently, the occupant leaves windows open for ventilation, including during our visit. Whilst the occupants are happy with minimal heating and low indoor temperatures in winter, they are considering the installation of an air conditioner for mechanical cooling in summer due to overheating.

2_Heating & Hot Water

In all cases, the dwellings have individual gas-fired boilers providing hot water and heating with radiators. The boilers are located in the kitchen on the south-east elevation or in some cases on the external terrace within an enclosure adjacent to the kitchen. Installation types include combi-boilers that provide heating and hot water without a hot water storage cylinder and boilers with hot water storage cylinders, typically located in the hallway of the property. A cold water header tank was observed in most of the inspected properties. Some residents noted water pressure was poor and have power shower pumps installed.

3_Cooling

In some cases, residents reported overheating was an issue and some have suggested that they may need to install mechanical cooling through air-conditioning units. Other residents noted that the dual aspect units performed well with cross ventilation in summer when windows were open on both sides of the property. It should be noted that the living room windows are south-east facing and unshaded resulting in a large area of exposed glazing that may lead to large solar gains and overheating in the summer. The performance of the existing glazing with respect to solar gain should be established as part of the retrofit assessment.

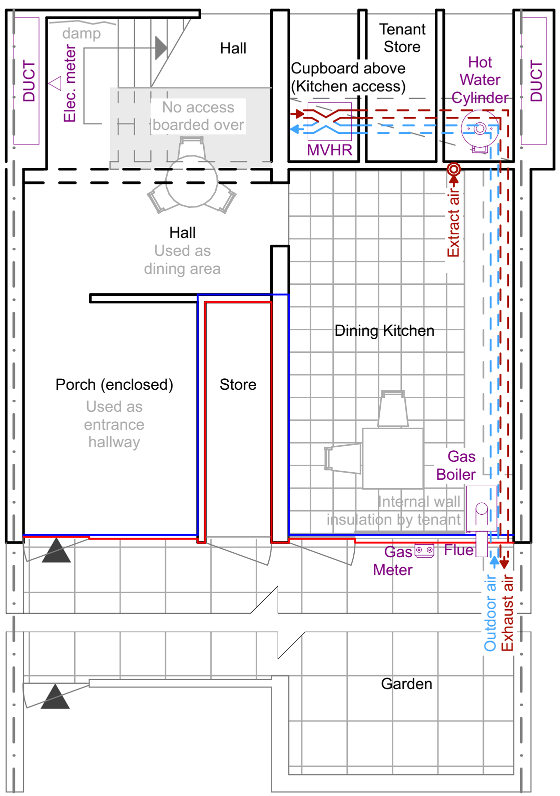
4_Fuel & Power

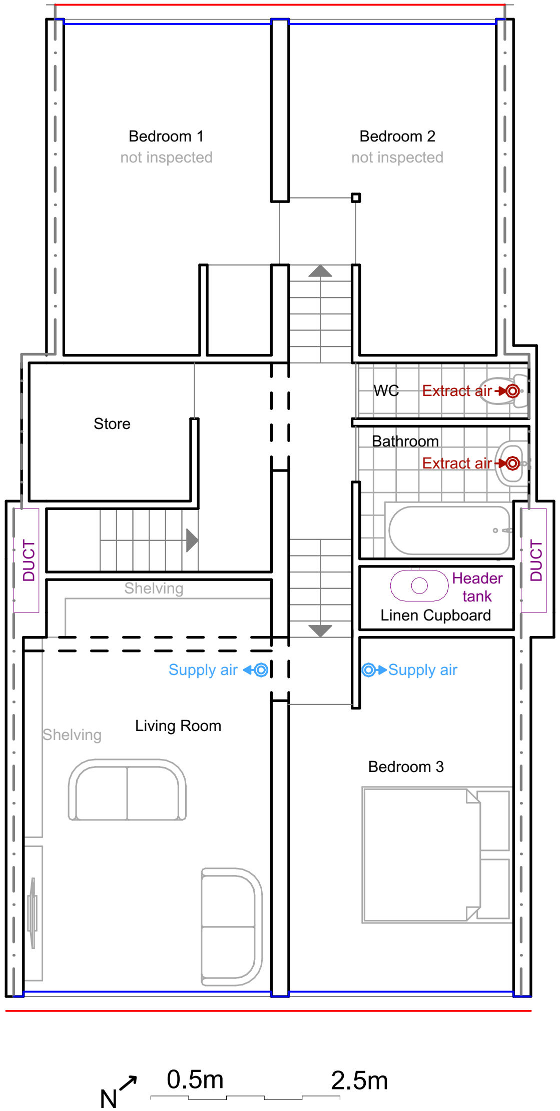
Electricity meters are typically located within the entrance hallway of each property. At the time of inspection, a new lateral power mains has been installed to each floor of the block, within the access corridor, but not connected to the service head/meter within each home. The gas supply runs laterally along the south-east elevation to gas meters located on the terrace outside each kitchens, near the boiler installation.

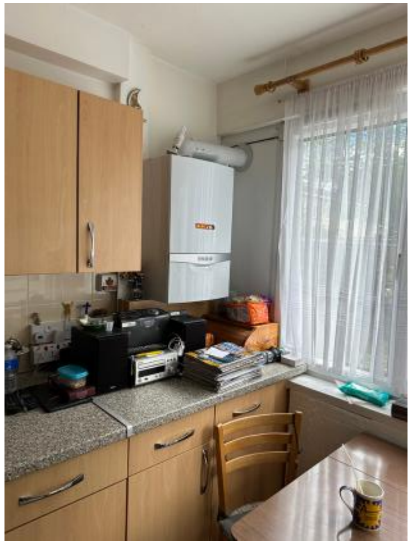
The south-east living room elevation of Bence House: there is considerable unshaded glazing that is likely to result in high solar gains - good in winter during heating season but potentially contributing to overheating in summer. Boiler flues extend across the terrace of each dwelling from the boiler installation in each kitchen, with the gas mains entering each dwelling below to the gas meter located on each terrace.

Typical Mechanical and Electrical Installation

Heating & Hot Water
Gas
Electricity
Ventilation







(far left) Type A flat, lower level floor plan; (left) Type A flat, upper level floor plan; (above left) Gas boiler in kitchen on lower level with flue to private garden; (above right) cold water header tank in bedroom service riser with MVHR ducts; (below) domestic hot water storage cylinder and MVHR unit within kitchen service riser.

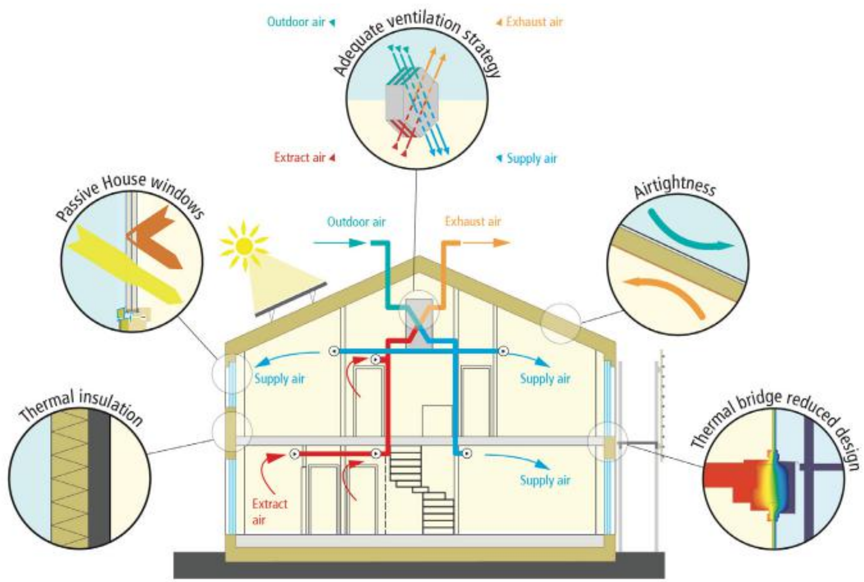
5_Recommendations

These recommendations are intended to complement (not replace) the data gathering and deep assessment of Bence House dwellings as part of a PAS2035 compliant retrofit process, described in the introduction.

Ventilation

The existing ventilation installations are a concerning aspect of the environmental design of the dwellings in Bence House. In most cases we observed, there was either an MVHR (Mechanical Ventilation with Heat Recovery) installation, that was either not functioning or very poorly performing, or there was no mechanical extract ventilation installed at all. As a consequence, there are issues noted in Section D2, that need to be addressed. If the ventilation situation in Bence House is reflective of the wider Pepys estate there is a significant risk of undermining decarbonisation initiatives if a viable and effective alternative is not implemented. A new ventilation strategy should be aligned with planned energy efficiency measures and improvements to building services. A viable and effective ventilation strategy should consider:

- Healthy and Comfortable Homes: Educating residents and stakeholders that good ventilation design is integral to good environmental design, which can improve indoor air quality, provide stable temperature and humidity, reduce noise, lower fuel consumption, lower bills. As a minimum, there should be an understanding of what is required for regulatory compliance, as set out in Part F of the Building Regulations (Ventilation).
- Accessibility and Clarity: A ventilation installation should be easy to access, maintain and operate; the location of equipment, controls, and filters needs to be carefully considered.
- Roles and Responsibilities: Establishing who is responsible for the ventilation installation within the dwellings, including: design, installation, commissioning and maintenance.
- Strategy: There are a range of ventilation strategies that should be considered, including, but not limited to, whole-house systems like MVHR. Essentially, a system should be chosen that aligns with the overall retrofit brief and objectives that can be realistically maintained by the responsible parties.



Adequate ventilation is at the heart of good environmental design strategies: Passivhaus is the gold standard in energy efficiency and comfort, with ventilation (in this case MVHR) being a key principle

Heating & Hot Water

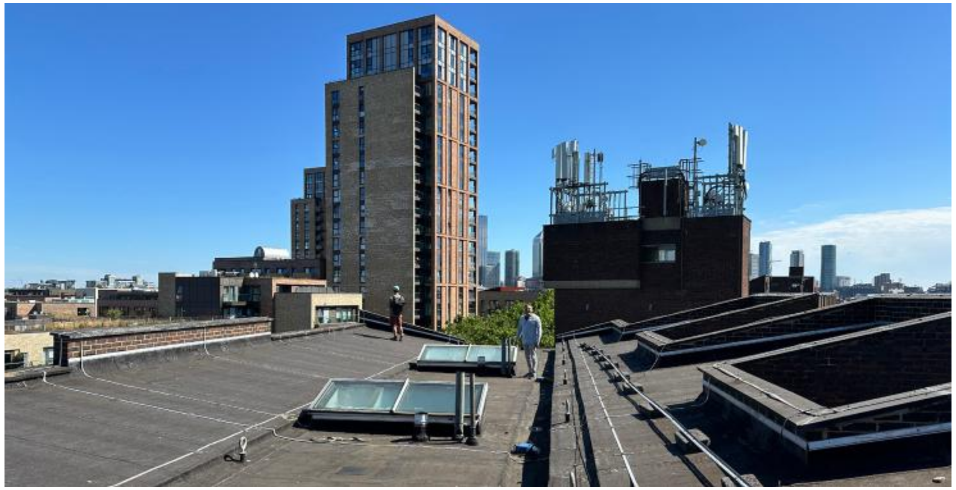
The UK government plans to phase out gas boilers over the medium term and Lewisham Council's targets may expedite their replacement more quickly still. Consequently, more sustainable alternatives to gas are considered in the 'Energy: from fossil fuel to renewables' section below. The heating and hot water strategy should align with the energy strategy whilst minimising disruption within each dwelling.

Cooling

Overheating, and cooling measures, should be considered within the retrofit process and further analysis is required to understand the extent of the issue. The most impactful measures to address overheating would reduce solar gain through south-facing glazing: incorporating external shading, and specifying glazing with low solar energy transmittance. If a sustainable mechanical cooling strategy is required then consideration should be given to including heat pumps as part of the retrofit plan.

Energy: from fossil fuel to renewables

Improvements described in this report, to the building fabric and building services, are a critical first step in delivering homes with low heating demand that are healthy and comfortable. Adopting this 'fabric first' approach, the design can consider how energy-efficient dwellings can transition effectively from burning fossil fuels to using electricity for heating and hot water. Furthermore, opportunities can be explored for renewable energy, adopting a regenerative energy strategy. Following consultation with Lewisham Council and Bence House residents, there seem to be two areas with opportunities for renewable energy: rooftops of the housing blocks to harness solar power and the estate's open spaces with the potential for extracting heat from the ground.



(above) Bence House roof with potential for solar power generation; (left) Rainsborough Avenue: a large open space running within the Pepys Estate with hard and soft landscaping, identified as a new 'green link' where landscaping could be coordinated with a ground source heat pump strategy

Solar Power (PV)

This study benefited from guidance from:
Bauder, recommended by Lewisham Council for advice on biosolar roof design
Carbon3, regarding solar panel design
Solshare, for how solar power can be distributed to flats

Solar photovoltaic (PV) panels installed on the Pepys Estate would convert sunlight into electricity to use in people's homes. Installing solar panels will allow residents to use free, renewable, clean electricity to power their appliances. Furthermore, when combined with a fossil-fuel free, electrified heating & hot water strategy, solar power can further reduce the estate's reliance on external energy suppliers. Early design analysis undertaken for this study by Carbon3 (see Supplementary Material 3) suggests that the Bence House roof could accommodate solar panels that could generate 31,800 kWh per year, saving 4.3 tonnes of CO2 per year. That equates to an average of 600kWh of free, renewable energy for each Bence House flat every year.

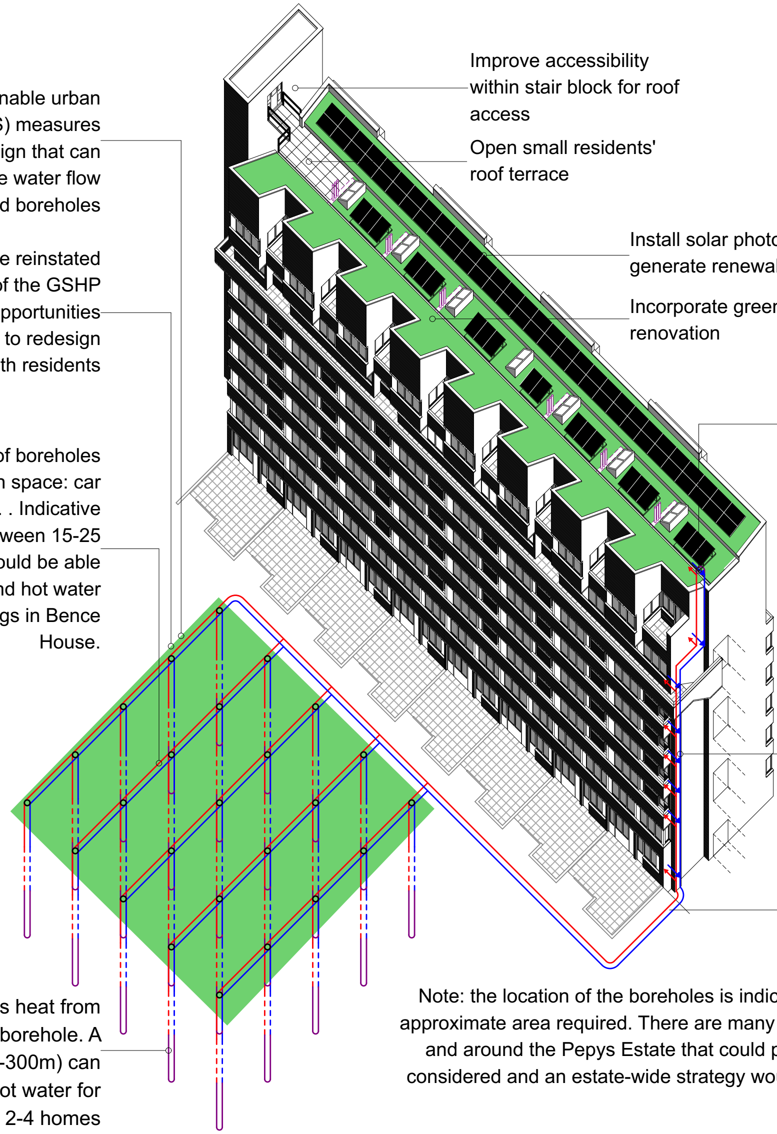
Early cost benefit analysis suggests that the installation cost of solar panels, when undertaken in conjunction with the installation of a biosolar roof, has a payback period of around 5 years and save each dwelling an average of £150 per year on their energy bills. The specification of the solar power system could also consider innovative methods of distributing the electricity generated, such as Solshare's system that enables the power to be apportioned according to dwelling size or heating demand (for properties with heat pumps).

Ground Source Heat Pump (GSHP)

This study benefited from guidance from the Kensa Group, recommended by Lewisham Council for advice on current GSHP plans for the Pepys Estate and heat pump design considerations.

A ground source heat pump (GSHP) uses the earth's natural heat to heat homes and provide hot water. It works with a ground loop: a network of pipes buried underground that absorbs heat from the ground. In the Pepys Estate, pipes would be buried in boreholes to maximise the heat generated within the available footprint of the estate's open spaces. It is therefore strongly recommended that a coordinated plan is developed for an estate-wide landscape strategy and GSHP design. The ground loop, pipe manifolds and distribution to the vertical risers in the housing block are buried below ground; a GSHP for Bence House could cannibalise the existing gas distribution and boiler installation. Heat pumps circulate a mixture of water and antifreeze through pipes buried in the ground to absorb the sun's energy stored in the soil. The low-grade energy is then compressed and condensed into a higher temperature, which is transferred to the building's heating and hot water system. Ground source heat pumps are highly efficient, producing 3 to 4 times more energy than they consume. This is because they harness free energy from the ground, which is naturally replenished and unaffected by air temperature changes. Kensa supply a 'Shoebox Heat Pump...a small, versatile unit' that can be fitted inside a cabinet or airing cupboard, essentially replacing the gas boiler installation within the dwelling kitchens. It can provide heating, hot water, and cooling, and can be configured to deliver passive cooling in the summer. Kensa heat pumps are electrically driven at the point of use within each dwelling so no external energy providers are required.

(top) Bauder Biosolar Roof diagram;
(below) Kensa Heat Pumps: diagram of ground loops and heat pumps and Kensa Shoebox Heat Pump



Axonometric view of Bence House with concept design for renewable energy strategy involving solar power and ground source heat pumps

E People & Energy-Efficiency

Interacting with People

Human behaviour is a significant factor in the success of an energy-efficient retrofit project, as it can affect the viability of the project. How occupants use their homes can impact the energy use. In Bence House for example, people may leave windows open while the heating is on, or use key services like ventilation systems incorrectly.

It is recommended that resident engagement is expanded and maintained in order that interest and involvement in the retrofit process is developed. To encourage residents to embrace energy efficiency, different strategies can be used for different types of people. For the more engaged, the focus can be on overcoming barriers such as financial costs. For the less engaged, the focus can be on stimulating debate about the benefits of carbon reduction and retrofitting, such as making healthier and more comfortable homes.

Lewisham Council as the estate management also have an important role to play by clearly defining their role and responsibilities and those of the residents, both council tenants and leaseholders.
This is of particular importance for monitoring and maintaining the performance of the building fabric, services and energy use. There is evidence from the home consultation reports that the manner in which the occupants and/or the Council monitor and maintain certain building services could be significantly improved. Historically, the core services of the building were based upon shared systems located in the centre of the block through risers that run from ground to roof; a benefit of a centralised system is that there is a clarity over monitoring and maintaining it.

Over time, the services have become largely atomised, in other words self-contained within each flat. The heating and hot water system, from a user interface perspective works well, in that the boiler is located in an accessible location within each kitchen adjoining a private external terrace (for the boiler flue and gas meter/ supply). There appears to be good provision of information on the heating and hot water system as occupants understand how to use and monitor it, and the maintenance and repair process, including the responsibilities of the council for council tenants.

Conversely, the ventilation system, a ‘whole house’ system like the heating system, has very poor user interface. Typically, the ventilation units are located in inaccessible places such as within bathroom service voids . Information on how to use, monitor and maintain the system does not appear to be available or well understood by occupants, for example, none of the residents we spoke to with MVHR installations had ever had the air filters changed.

A key finding from this study with respect to occupancy and use, underlines the PAS 2035 principle that each home is unique. An identical flat type could be lived in by a single adult who is only home weekday evenings or by a family where occupants are home all the time. It is important to understand that a successful retrofit design for Bence House is based not on 1 but 53 bespoke studies.

The design of services, their location, the user interface and provision of information are an important consideration for a successful retrofit design.
(left) a gas boiler is located in a visible location in the kitchen with an accessible control panel, where the critical external components (e.g.. flue) are easy to maintain and monitor.
(right) the ventilation unit is concealed within a WC service void, where controls, ducts and filters are hard to use, monitor and maintain.

F
Green Space Opportunities

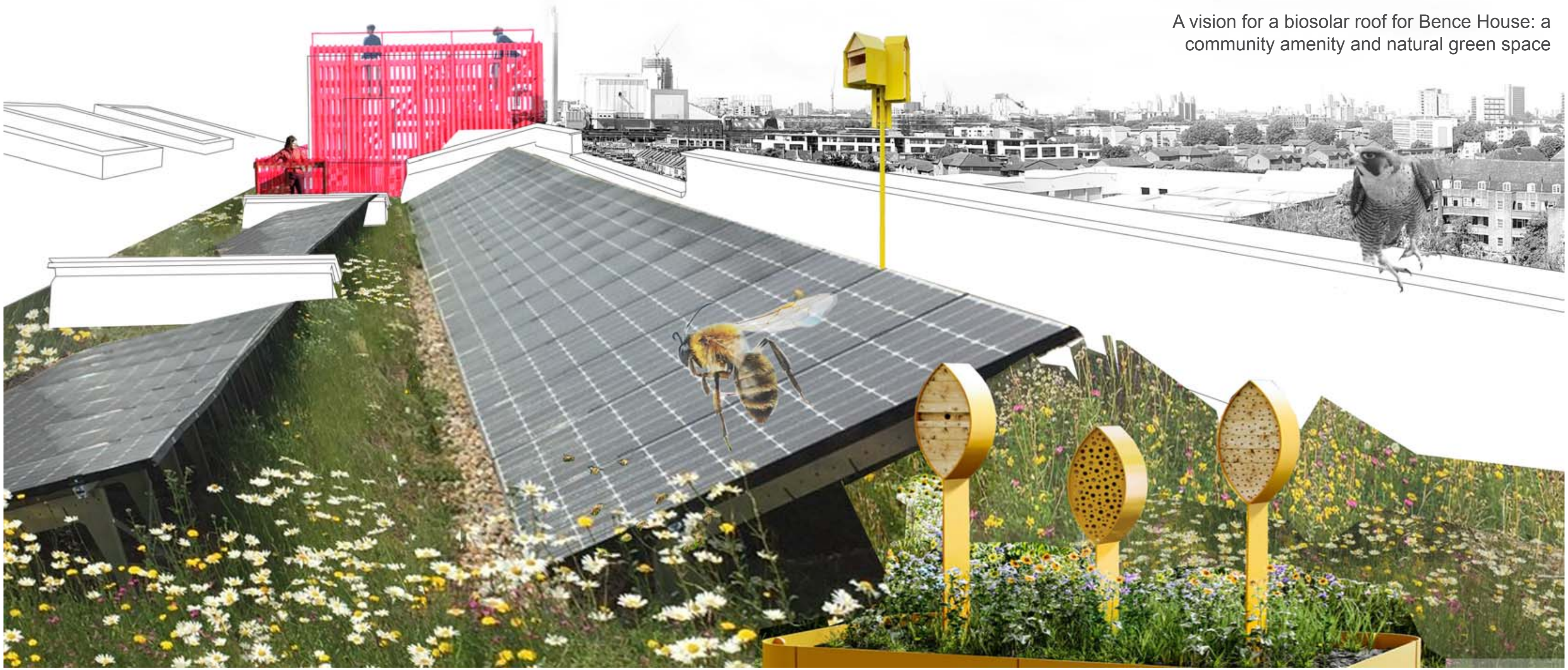
Greening through Energy-Efficiency Measures

The ambitions of the Bence House residents for their housing are aligned with a vision for Evelyn Ward to aspire to be the first Garden Ward in Lewisham; where a project such as this, with its ambitions for more energy-efficient, comfortable and healthy homes is also an opportunity to improve and create green space. Equally, this report aims to help the council and residents to facilitate green space improvements through the necessary retrofit work being planned.

The starting point for this study was the imminent need to replace the degraded roof of the block and an opportunity to go beyond the necessary energy-efficiency and water-proofing work that is required. The roof space is an ideal place to consider renewable energy, in the form of solar panels discussed in Section D5 but also an opportunity to ‘green the grey’ by creating approximately 500 square meters of green space over a bitumen roof. A green roof can improve air quality, reduce storm water runoff, and promote biodiversity.

The concept design for a biosolar roof at Bence House can be seen in Section D5 which also shows a small roof terrace for use by the Bence House community, to enjoy the new green space and spectacular London views. Safety and accessibility work will be required to enable a roof terrace at Bence House. The residents have discussed the potential of the renovated roof including rainwater harvesting and food growing. Ecological specialists in the council have also expressed an interest in locating bird and bat boxes at roof level. In summary, future design iterations for a biosolar roof should consider its potential as a community amenity and natural green space.

Importantly, there is also a study required to align the neighbourhood green space vision for the Pepys Estate set out in *Greening Evelyn (2024)* with the plans to use Ground Source Heat Pumps as a source of renewable energy for heating and hot water on the Pepys Estate, as suggested in the concept design in Section D5. This study would overlay sites with landscaping opportunities with the ground loop arrays required to deliver the required heating and hot water. Such as study is an opportunity to redesign open spaces with residents and build support for the GSHP by combining a renewable energy strategy with a community-led green space and public realm design.



A vision for a biosolar roof for Bence House: a community amenity and natural green space

Glossary

Term	Definition
Airtightness	A measure of how much air naturally leaks out of or into a building, for example through cracks in walls or gaps around windows.
Building Fabric	A term used to describe all components that separate the interior from the exterior: the walls, roof, floor, windows and doors.
Carbon Footprint	The amount of carbon emitted by someone in a period of time.
Carbon Dioxide (CO2)	A greenhouse gas.
Energy Efficiency	The relative amount of energy needed to deliver a stated aim, for example keeping your home at consistent, comfortable temperatue.
Greenhouse Gas	A greenhouse gas in the Earth's atmosphere traps heat, warms the planet and contributes to global climate change
Ground Source Heat Pumps (GSHP)	An electric heating system that extracts natural heat from the ground to provide hot water and heating for a dwelling.
Heating Demand	The amount of energy needed for spaces to be heated to a comfortable temperature.
Kilowatt Hour (kWh)	A measure of the amount of energy used or generated in one hour.
Mechanical Ventilation with Heat Recovery (MVHR)	A ventilation system for the whole house that recovers heat from extracted air before it is exhausted from the building and used to warm the supply of fresh outdoor air.
Renewable Energy	Energy produced from a renewable source, like from the sun or the natural heat of the ground.
Retrofit	The introduction of new energy-efficiency measures to an existing building, primarily to reduce energy use and carbon emissions but often also to generate renewable energy.
Solar Photovoltaic Panels (PV)	A type of renewable electricity generated from solar energy, typically being panels installed on unshaded, south-facing roof areas.
Thermal Bridge	A part of the building fabric that loses more heat than adjoining areas, that becomes the path of least resistance for heat to travel out of the building.

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Bence House
Tenants Residents Association

bencehousetra@gmail.com

WonKy

email: info@wonky.space
URL: wonky.space
Instagram: wonky.space
Linkedin: company/wonky-space

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arb Architects Registration Board
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