Team ZH

TOP DOWN: SYHA - WHINN DALE

Wakefield, United Kingdom

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WHINN DALE | SYHA

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1.0 Introduction

SUSTAINABILITY

Climate change is one of the most profound global challenges facing humanity since the industrial revolution (IPCC, 2018). It is expected that climate change will result in temperature increases of over 1.5°C above pre-industrial levels for the next generation without significant intervention, such as a rapid decline in greenhouse gas emissions (IPCC, 2019).

According to OECD (n.d.), the UK is ranked 16th in global emissions contributing 1.1% of the 49 billion tonnes of CO_2 equivalent in 2015 (Bolton, 2020).

Of this 1.1% of the UK's global emissions contribution, 40% is provided by housing (Committee on Climate Change, n.d.) with the NHS reporting that **0.42% of the 2009 UK carbon footprint was a direct result of residential carehomes** (Stringer, 2012)

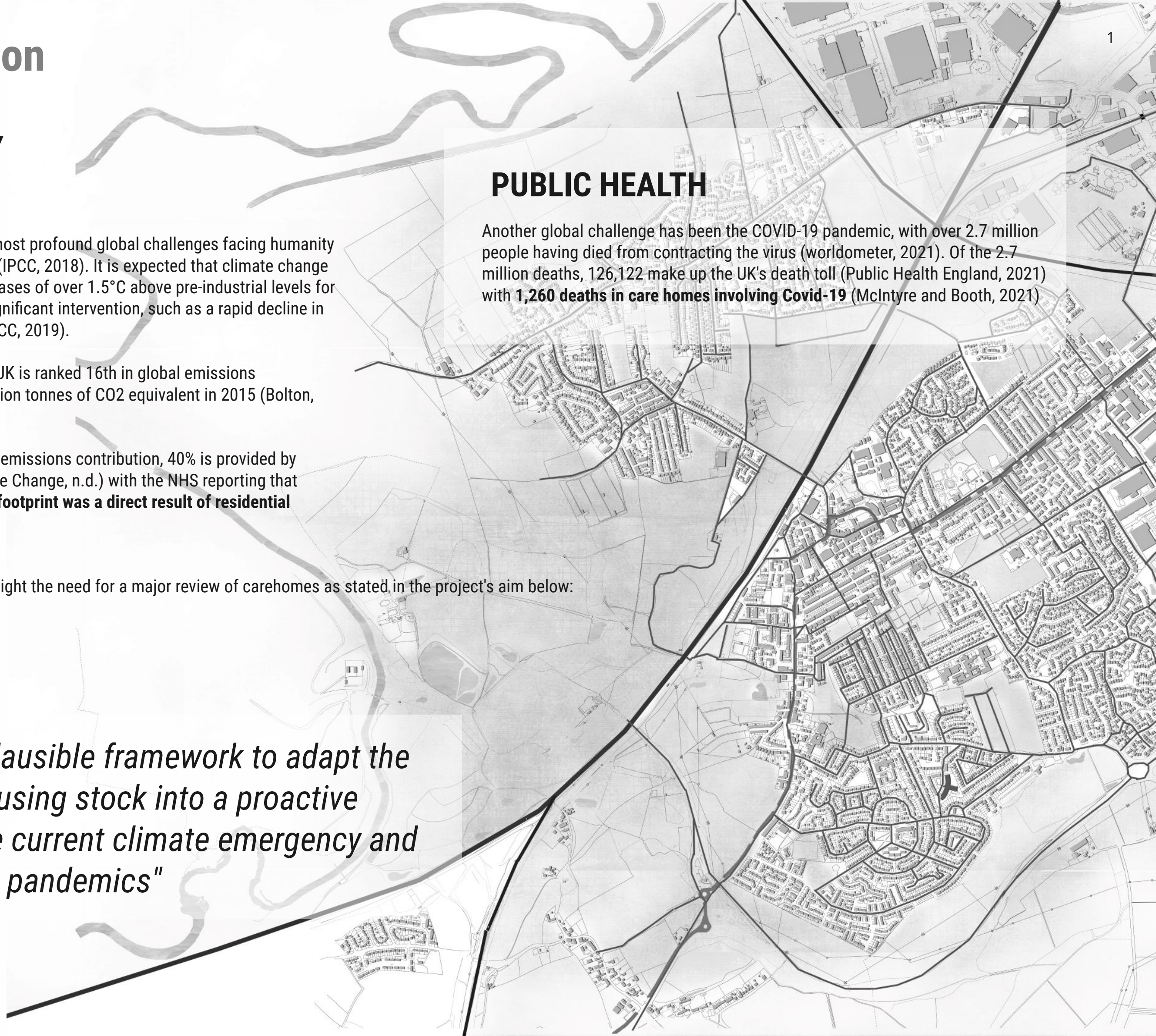
PUBLIC HEALTH

Another global challenge has been the COVID-19 pandemic, with over 2.7 million people having died from contracting the virus (worldometer, 2021). Of the 2.7 million deaths, 126,122 make up the UK's death toll (Public Health England, 2021) with **1,260 deaths in care homes involving Covid-19** (McIntyre and Booth, 2021)

These concerning figures highlight the need for a major review of carehomes as stated in the project's aim below:

AIM

"To provide a plausible framework to adapt the current care housing stock into a proactive approach to the current climate emergency and potential future pandemics"



2.1 Approach and Energy Consumption Statistics

A significant portion of the UK housing stock is dated. 19.5 million homes in the UK were built before 1990 and 4.7 million built before 1919. Given the construction technique, quality and, priority, the dwelling age is a strong indicator of energy inefficiency. Pre-1919 dwellings have an average of 23 SAP points fewer than those built after 1990 and therefore, mean CO2emissions per dwelling were twice those of post-1990 stock.
The Energy Performace Certificate (EPC) rating is based on the SAP score (Standard Assessment Procedure). On a scale of 0-100, a higher score indicates lower running costs. A score of 100 indicates that no heating or hot water costs are required for that building.

Decarbonisation goals

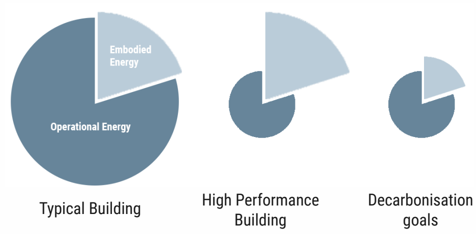


Figure 1: Decarbonisation Goal

UK Housing Stock - Energy Consumption

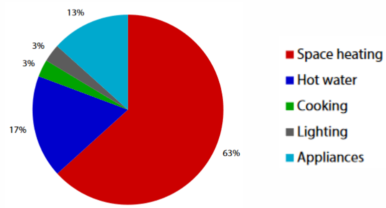


Figure 3: BEIS (2018) Energy Consumption in the UK (Existing homes)

Figure: https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf

The **World Resources Institute** recommends a **priority-based strategy list** for decarbonisation.
For **operational emissions**: Energy efficiency before renewable energy; on-site renewable energy before off-site renewable energy; and renewable energy before carbon offset (investing in renewable energy elsewhere).
For **embodied emissions**: Carbon reduction before carbon offset. Carbon offsetting is a low priority because it is only recommended for cases where a 100% renewable energy supply is not feasible. Therefore, the three levels of decarbonisation or the approach include:

- The **reduction of operational carbon** in existing buildings through energy efficiency;
- **Use renewable energy** to cover the remaining low energy demand, ideally on-site or offsite nearby if necessary;
- **Reduce** the **embodied carbon** of new buildings and retrofits over their entire life cycle.

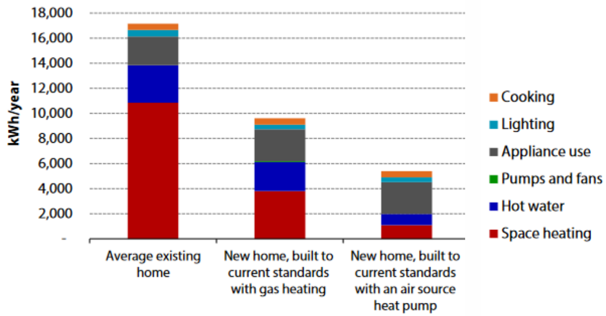


Figure 4: BEIS (2018) Energy Consumption in the UK (Existing and New Build)

Figure: https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf

The Approach

Figure 2: Decarbonisation Priority List

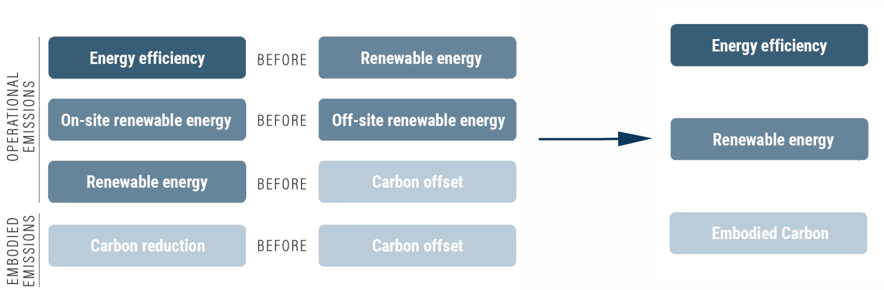


Figure and Text: https://www.archdaily.com/938866/urgent-issue-10-strategies-to-decarbonize-architecture
Text: https://switchee.co/wp-content/uploads/2019/07/Decarbonising-the-UKs-Housing-Stock.pdf
https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf
https://www.rics.org/globalassets/rics-website/media/news/news--opinion/retrofitting-to-decarbonise-the-uk-existing-housing-stock-v2.pdf

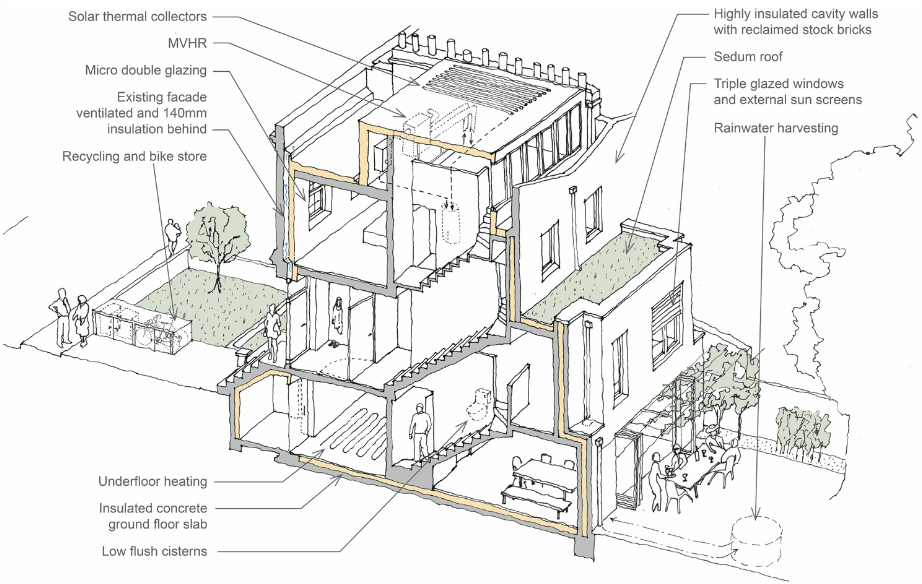
Summary

- The sustainability strategy includes - **energy efficiency, renewable energy** and **reducing embodied carbon.**
- To employ these strategies, it is important to first identify the primary sources of energy consumption - **space heating and hot water**. Our solutions will therefore prioritise these sources.

2.2 Relevant Retrofit Example

80% House - Prewett Bizley

Figure 5: Working Principle



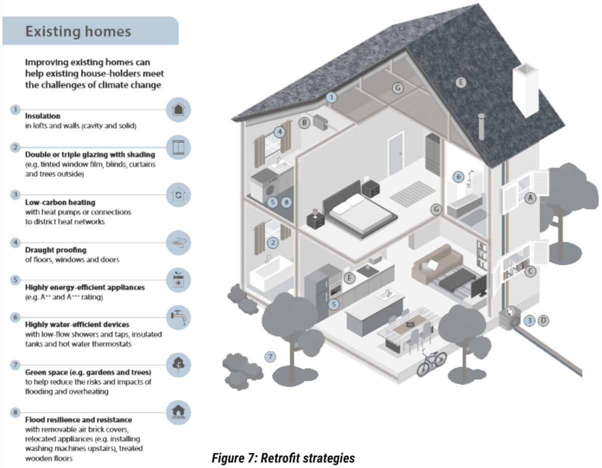


Figure 7: Retrofit strategies

Figure: https://www.theccc.org.uk/wp-content/uploads/2019/02/UK-housing-Fit-for-the-future-CCC-2019.pdf

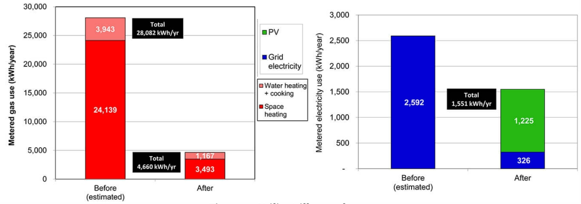


Figure 8: Utility Bills Graph

In order to better understand the larger Whinn Dale development, a case study equivalent to the size of one unit was first considered. This case study in particular considers similar end users.

Building inside a building approach - because the house has a significant historic value. Generally, the cost-efficient procedure would be to proceed with a 'building outside a building approach'.

Extreme refurbishment - a retrofit of a Victorian terrace house in order to reduce carbon emissions of such properties

The project is named the '80% house' because it achieves an 80% reduction in CO2 emissions, primarily by incorporating high levels of insulation and achieving an airtightness of 1.1 ach @ 50 Pa

Fresh air is supplied by an MVHR (mechanical ventilation heat recovery) system.

Photovoltaic panels on the roof provide a 1000 kWh/a output which provides a little over half the annual electricity requirement.

Figure and Text: http://www.prewettbizley.com/built-project-80-house-index

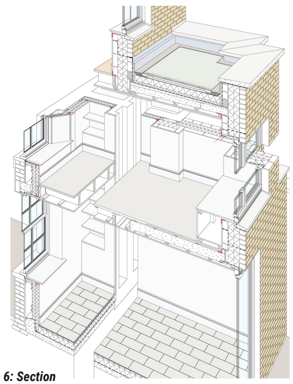


Figure 6: Section

Summary

- Although, **airtightness and fabric efficiency are prioritised** to reduce energy consumption as a result of heating demands, addressing concerns of **flooding and overheating** have been equally considered.
- Occupant requirement in terms of the connection to a 'home' is also prioritised by **including biophilic design**.

2.3 BREEAM

In order to assess the existing and proposed elements on this project, BREEAM has been adopted as a benchmark standard. Throughout the report, constant reference will be made to the existing and proposed conditions and how they contribute to achieving the required BREEAM standard:

United Kingdom → Refurbishment and Fit-out → Residential Institution → **UK Non-domestic Refurbishment** → Targeted BREEAM Score → **Outstanding ≥85%**

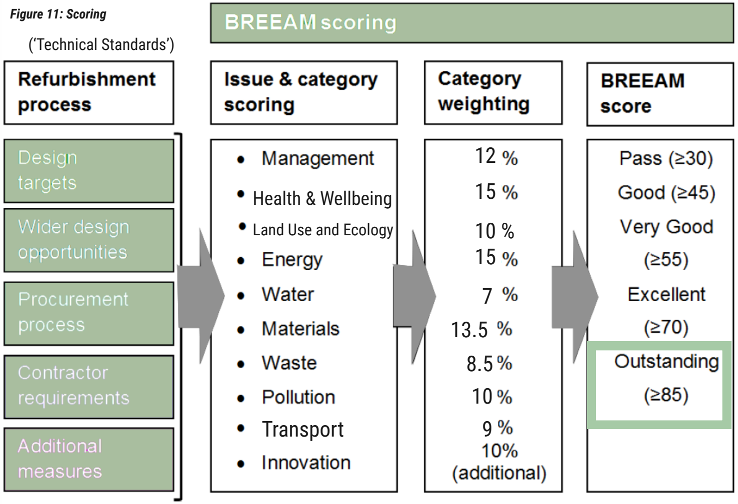
BREEAM is an international scheme that provides independent third party certification of the assessment of the **sustainability performance** of **individual buildings, communities and infrastructure projects**.

UK Refurbishment and Fit-out 2014
Non-domestic buildings SD216 2.0
('Technical Standards')

Figure 9: BREEAM Manual

Figure 11: Scoring

('Technical Standards')



10 Environmental Categories

Figure 10: Technical Standards Categories

('Technical Standards')

BREEAM UK Refurbishment and Fit-out 2014 scope and Multi-residential buildings

1. Student halls of residence
2. Key worker accommodation
3. **Care homes** that do not contain extensive or specialist medical facilities (limited consulting rooms and medical rooms are acceptable)
4. Sheltered housing
5. Other multi-residential buildings which contain a mix of residential accommodation with communal areas such as some military accommodation.

Summary

- Aiming to achieve **Outstanding** rating of BREEAM which needs a score **above 85%.**

2.4 The WELL Standard

Covid 19 & older people

The Covid-19 pandemic has **hit the older population more than other age brackets,** as their weaker immune system makes it harder to fight diseases and infection. Although all age groups are at risk of contracting the virus, older people face significant risk of developing a severe illness. Of all coronavirus-related deaths so far, 95% occurred in those older than 60 years. More than 50% of all fatalities involved people aged 80 years or older (Kluge, 2020).

Strategies- The Well Standard

A number of building strategies based on **the Well standard** have been taken into consideration.
WELL is a Standard for buildings, interior spaces and communities seeking to implement, validate and measure interventions that support and advance human health and wellness.

Air	Thermal Comfort
Water	Sound
Nourishment	Materials
Light	Mind
Movement	Community

(WELL v2 consists of 10 concepts focused on human health)

Air

Air stagnation may concentrate airborne viruses or dust, so it is critical to keep indoor air as refreshed as possible. Accroding to Gubb (2020), a research has shown that increased ventilation in a building can reduce the chance of influenza.
Without proper maintenance and filtration, heating, ventilation and air conditioning systems can build up mold and particulates that can propagate respiratory diseases, especially after periods of inactivity.

Ventilation Effectiveness - WELL Feature A03

Bring in fresh air from the outside through mechanical and/or natural means to dilute human and product-generated air pollutants.

Enhanced Ventilation - WELL Feature A06

Implement advanced ventilation strategies such as increased outdoor air supply, demand-control ventilation, displacement ventilation and advanced air distribution that can enhance air quality.

Figure 12: All images - Well Standard

Operable Windows - WELL Feature A07

Provide operable windows and encourage building users to open windows when outdoor air quality is acceptable.

Air Filtration - WELL Feature A12

Implement adequate air filtration and document a maintenance protocol for installed filters.

Smoke-free Environment - WELL Feature A02

Deter smoking, minimize occupant exposure to secondhand smoke and reduce smoke pollution.

Water

There is also evidence that **humidity** can play a role in the survival of viruses such as COVID-19. As such, maintaining relative humidity between 40% and 60% may help to limit the spread and survival of COVID-19.Organizations should weigh the effectiveness and complexity of humidification systems against other air purification strategies.

Moisture Management - WELL Feature W07

Implement design strategies to limit moisture accumulation and the potential of mold growth from water infiltration and condensation within buildings.

Fundamental Water Quality - WELL Feature W01

Meet performance thresholds for turbidity and coliforms for all water likely to come in contact with building occupants.

Water Contaminants - WELL Feature W02

Provide drinking water that meets performance thresholds for dissolved metals, organic pollutants and disinfectants.

Enhanced Water Quality - WELL Feature W04

Provide drinking water that meets performance thresholds for contaminants that affect aesthetics and taste.

Light

The lighting environments where humans spend their time impact their visual, circadian and mental health. Currently, lighting conditions in most spaces are designed to meet the visual needs of individuals but do not take into account **circadian** and **mental health**. This presents an opportunity for projects to provide lighting conditions required by humans for optimal health and well-being.

Circadian Lighting Design - WELL Feature L03

Provide appropriate exposure to light for maintaining circadian health and aligning the circadian rhythm with the day-night cycle.

Light Exposure and Education - WELL Feature L01

Provide appropriate light exposure in indoor environments by using daylighting or electric lighting strategies, and provide education about the importance of light for health.

Enhanced Daylight Access - WELL Feature L05

Integrate daylight into indoor environments and provide windows with views outside.

Thermal comfort

Humidity Control - WELL Feature T07

Limit the growth of pathogens and maintain relative humidity levels that are conducive to human health and well-being.

Community

In addition to policies and programs that support healthy, equitable environments, it is key for project teams to consider design approaches that address the physical determinants of **health** and **well-being** by **making buildings inclusive, accessible and safe** for all. Accessible spaces are not just compliant with code but also incorporate universal design principles that support diverse ability and mobility and encourage people of all backgrounds to use a space.

Emergency Preparedness - WELL Feature C15

Develop an emergency management plan and supporting resources.

Family Support - WELL Feature C10

Enable working parents and caregivers to care for members of their family.

Enhanced Occupant Survey - WELL Feature C04

Collect and respond to in-depth feedback from building users on their comfort, satisfaction, behavior, health and other robust factors related to their well-being, both before and during occupancy.

Civic Engagement - WELL Feature C11

Encourage the creation of opportunities for individuals to become actively involved in and connected to the surrounding community through engagement and volunteerism.

Community Access and Engagement- WELL Feature C16

Create opportunities for community members to connect and collaborate.

Mind

The **built environment** serves as a powerful tool to help **mitigate those adverse mental** health outcomes through policies, programs and design.

Access to Nature - WELL Feature M02

Incorporate nature into the design of interior and exterior spaces by integrating plants, water, light and views, as well as natural materials, patterns, colors or images.

Mental Health Promotion - WELL Feature M01

Promote mental health and well-being through a commitment to mental health education, programming and initiatives.

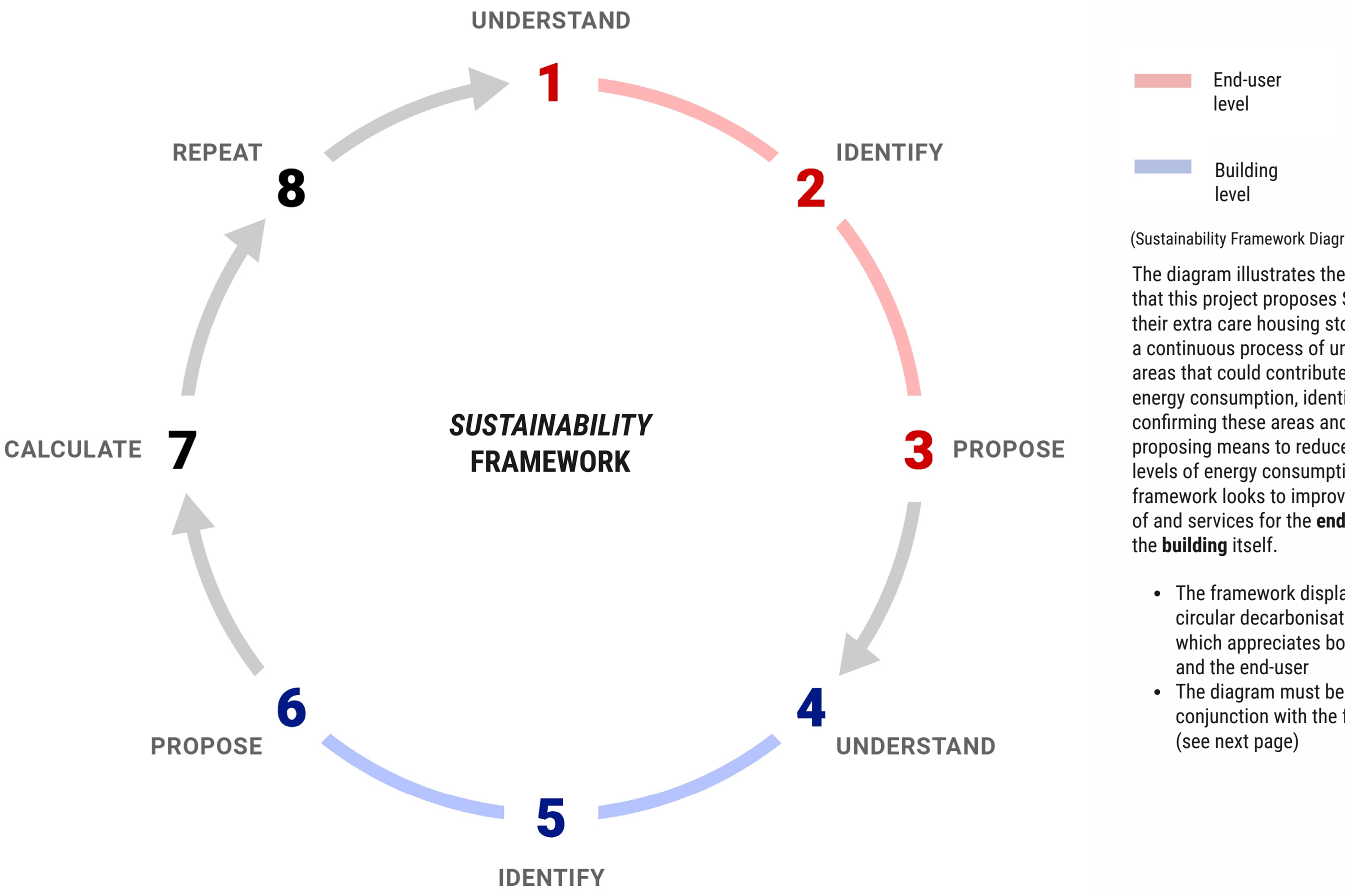
Material

WELL stipulates that all **regularly-used surfaces** meet antimicrobial criteria set by the U.S. Environmental Protection Agency to kill and prevent microorganism growth. Both **copper** and **brass** perform well in this regard, as confirmed in the above study investigating COVID-19's lifetime on surfaces.

Summary

- Older people are more susceptible to **COVID-19**, and buildings for the elderly have been hardest hit by the pandemic.
- In order to make buildings for the elderly COVID resistant, the **Well standard offers a range of building strategies**, mainly in the aspect of **air** (ventilation, operable windows, air filtration), **water** (control of air humidity between 40% and 60% where it is most unsuitable for virus survival, control of water quality), **lighting** (control of lighting to enhance the well-being of the elderly and to regulate circadian rhythms), and **community** (improving the efficiency and quality of management and services through building design).

3.0 Sustainability Framework Diagram



(Sustainability Framework Diagram, Author's Own)

The diagram illustrates the **framework** that this project proposes SYHA to use on their extra care housing stock. It involves a continuous process of understanding areas that could contribute high levels of energy consumption, identifying/ confirming these areas and then proposing means to reduce these high levels of energy consumption. The framework looks to improve the behaviour of and services for the **end-user** as well as the **building** itself.

- The framework displays a constant circular decarbonisation approach which appreciates both the building and the end-user
- The diagram must be read in conjunction with the framework table (see next page)

3.1 Sustainability Framework Table

Number/ Title	What?	How?	Why?
1 - Understand	User energy comsumption based on the building's current operation	By analysing current user behaviour patterns	To understand how much current user behaviour contributes to the current building's total energy comsumption
2 - Identify	User behaviours which contribute a high percentage of energy comsumption	Research into typical user behaviour patterns and day-to-day activities	To provide an array of user activites and behaviours relative to their respective energy comsumption
3 - Propose	Orgonomics and user friendly controls which would result in changing user behaviour to reduce energy comsumption	Analyse current user behaviour and proposal how to optimise this for sustainability	To reduce the energy comsumption of the building's users
4 - Understand	The current energy comsumption of the existing building/site	Through the use of building simulations	To compare how the building performs against certain benchmarks
5 - Identify	Elements of the existing building/site which contribute a high percentage of energy comsumption	Analyse simulation outputs against current benchmarks i.e. AD-L	To priortise certain strategies
6 - Propose	Strategies to make building elements energy efficient	Research into effective sustainable building strategies	To explore how feasible the proposed strategies are
7 - Calculate	Whether a reduced energy consumption has occured	Through the use of Sofie Pelsmaker's Climate Emergency Design Themes	To identify whether steps 1 and 6 have been effective
8 - Repeat	Repeats steps 1-7	By using the proposed sustainability framework	To constantly review the proposal as climate conditions and user behaviour patterns could change in the future

End-user level

Building level

(Sustainability Framework Table, Author's Own)

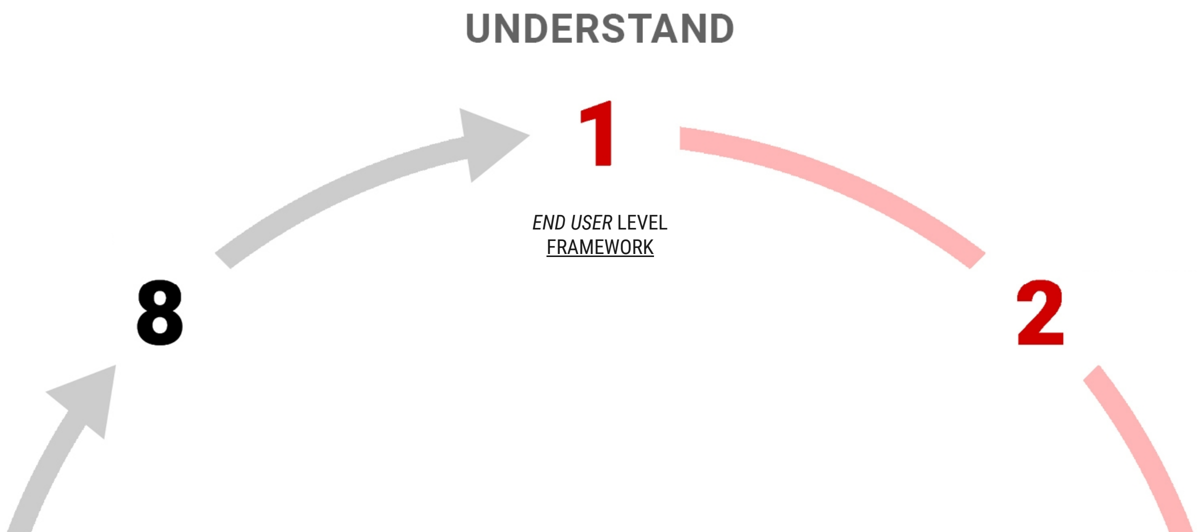
Summary

- The table sets out **manageable and achievable measures** to apply to the proposed Sustainability framework
- The steps must be followed in chronological order to ensure sufficient research and analysis is conducted before implying any proposals

Sustainability Framework

SUSTAINABILITY FRAMEWORK

The end-user will be analysed throughout the next few pages to identify where their behaviour contributes to high levels of energy consumption.



4.1 Their Business

SYHA

SERVICES

- Over 55's
  - Livewell at Home
  - Extra Care Housing
  - Age Better in Sheffield
- Homeless
  - Temporary Accommodation
  - Non-Conditional Housing
  - Support services
- Mental Health
  - Living Well
  - Extra Care Housing
- Learning Disabilities
  - Living Well
  - Extra Care Housing
- Social Prescribing
  - Non-Medical Support
  - Social Invervention

The Over 55's Extra Care Housing (focus service for this design project) offers the following to it's customers (SYHA, n.d.):

- *"Two bedroom apartments or bungalows*
- *One-to-one support from a named keyworker*
- *Fully fitted kitchen, lounge and level access wet room*
- *Access to the restaurant, laundry, PCs, recreational space and communal gardens*
- *On-call warden available 24 hours a day"*

As well as these services, customers are also offered the following activities (SYHA, n.d.):

- *"Coffee mornings*
- *Gardening*
- *Quiz nights*
- *Meals out"*

All of these existing activities offered to the customers already contribute towards the 'Community' and 'Mind' aspects of 'The Well Standard' as identified in pages 2.4

WHO?

According to Mitchel (2021), SYHA have the following profile:

- *"Not for profit Registered Social Landlord*
- *Started in 1972 as 'Sheffield Family Housing Association'*
- *6,000 homes across Sheffield City Region*
- *Support provided to over 10,000 people"*

All services assist in:

- Celebrating and promoting independency
- Increasing income for the customer
- Increasing local and regional economy
- Offering the opportunity to reintegrate into a community

(SYHA, n.d.)

Figure 13: Whinn Dale

Summary

- South Yorkshire Housing Association (SHYA) have a very **well structured framework** to provide housing and support, therefore the Sustainability Strategies; Retrofit: Top Down Approach framework must follow **a similar, well-structured framework**

4.2 Current Customers

SYHA'S CURRENT CUSTOMERS

SYHA customers are involved in every area of South Yorkshire Housing Association; they are members of the Board of Directors and work together to provide SYHA's services and oversee SYHA's work.
And **not all** of SYHA customers are tenants, but also include government and investors, etc.

RELATIONSHIP WITH CUSTOMERS

- Every month a group of tenants and clients get together to give SYHA their opinions, insights and endorsements on a variety of issues.
- Promoting Independence Project: The program is designed to help people who are living in nursing homes but want to return to independent living.

CUSTOMERS OF WHINN DALE

Whinn Dale provides supported housing for people **over the age of 55** living in the Wakefield area.
The properties are specifically designed to meet the needs of seniors who want to live independently, while maintaining a range of supportive services.

Figure 14: Whinn Dale Residents

SYHA's STRATEGIC PLAN (CUSTOMER RELATED)

SYHA's strategic plan sets out six themes for the next three years, they are:

1. Developing relationships with customers

2. Doing the basics brilliantly

3. Growing what SYHA does well

4. Tackling the climate emergency
（For example, SYHA monitors the average energy consumption of all new homes (KWh/m2) and focuses on increasing the proportion of households using low carbon heating)
In response to SYHA strategic plan, and in particular the climate strategy, this project will focus particularly on predicting future energy consumption and proposing means to reduce this where possible.

5. Being an excellent employer and great place to work

6. Creating a digital, data-driven, agile business
SYHA has a well-developed digital management capability and places emphasis on developing monitoring and reporting of building data.

This is a key way of providing a sustainability framework as data/digital performance monitoring will allow for continuous improvement.

https://www.syha.co.uk/wp-content/uploads/Strategic-Plan-Impacts.pdf

By achieving these strategies, SYHA expects to have a positive impact on businesses and families. These tables show the impacts SYHA expects to have on its customers and business. The second column of Example metrics shows a series of evaluation indicators that reflect SYHA's current customer strategy focus.

Impact	Example metrics	Theme
Impact on our customers		
8. We and our customers can be proud of our homes and estates: standards and energy/carbon efficiency are maintained and improved.	Net present value * Average & minimum SAP & EI rating *	2, 3, 4, 6
9. We are addressing the climate emergency through the standard of our new homes.	Average KWh/m2 for all new build homes * % of all homes using low carbon heating *	2, 3, 4
12, Our business is equipped to be agile.	Number and % of our people who have One Plus device and Office 365 * Number and % of our workspaces that meet the ambitions of our strategy *	2, 4, 5, 6
13. Our data is complete, automated and can be trusted.	Completion of data sets (range of areas) * Number and % of reports that are automated and published centrally *	1, 2, 3, 4, 5, 6

Summary

- SYHA's current client base is **primarily tenants**, but also includes other special clients such as governments, organizations, investors, etc.
- SYHA has a systematic and organic customer service mechanism. Receiving feedback from and working with clients on development plans is a feature of its customer strategy.
- SYHA's strategic plan has inspired our design, particularly in the areas of customer relations, **climate change control** and commitment to **digital management**.

SYHA

4.3 Potential Customers

LIFE EXPECTANCY

The overview below provided by Public Health England (2018) indicates that the number of potential customers for SYHA is likely to increase:

- *"in 2017, the percentage of the population aged 85 years and over was **2.7 times** greater than it was in 1971".*
- *"The number of people aged 85 years and over is expected to increase substantially in the future. In 2017 there were 1.35 million people aged 85 and over in England. By 2023 this is projected to reach 1.54 million (**an increase of 14%**) and in 2031 (when 'baby boomers' born after World War 2 move into this age group) it could reach 2.01 million".*

PENSION/RETIREMENT AGE

According to HM Treasury (2021), the pension age will increase from **age 55 to 57 in 2028**. This implies that SYHA's potential customers will decrease at the lowest age bracket as people are expected to work longer due to the increased life expectancy. This decreases the number of potential customers as it will encourage individuals to live independently as the will still be involved in a community through their place of work.

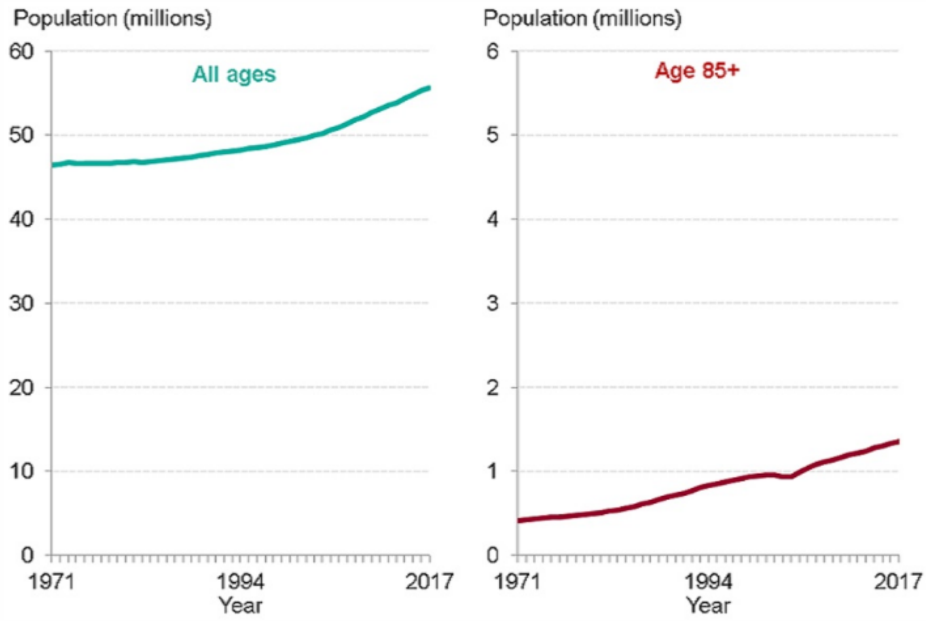


Figure 15: Public Health England, 2018

Summary

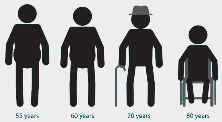
- The number of potential customers over 85 is **likely to increase.**
- The number of potential customers in the lowest age bracket (55-57) **will decrease.**
- A longer life expectancy indicates **customer's will be using SYHA's service for longer**, suggesting each customer will consume more energy. Therefore SYHA's should **increase on-site energy production to meet localised demands**.

SYHA

4.4 User Analysis

End user and staff

The diagram displays all of the existing end-users of SYHA's extra care services and certain key behaviours which may contribute to a high energy consumption.



Over 55

Belongingness

- **<u>to feel like a 'home'</u>**
- interests (gardening, for example)

Loneliness

- form friendships and connections
- **<u>social interactive</u>**
- connected to community

Secure

- **<u>to feel safe (named keyworker)</u>**

What Older People Want from Home Care Services – Commissioning Home Care for Older People. Retrieved March 8, 2021, from https://www.scie.org.uk/publications/guides/guide54/what-older-people-want.asp

<u>Live independent</u>

In the SYHA interview video, the inhabitant said, "We are independent but you know someone is there when you need it."
('Over 50s') South Yorkshire Housing Association | SYHA. Over 50s. Retrieved March 8, 2021, from https://www.syha.co.uk/wellbeing/find-a-service/over-50s/

<u>Achieve their aim to be independent with social connection</u>

Visitors

Interactive

- more private and public spaces for visitors

Connection

Staff

Rest

- more space or add flat for night shift (rest or nap)

Service

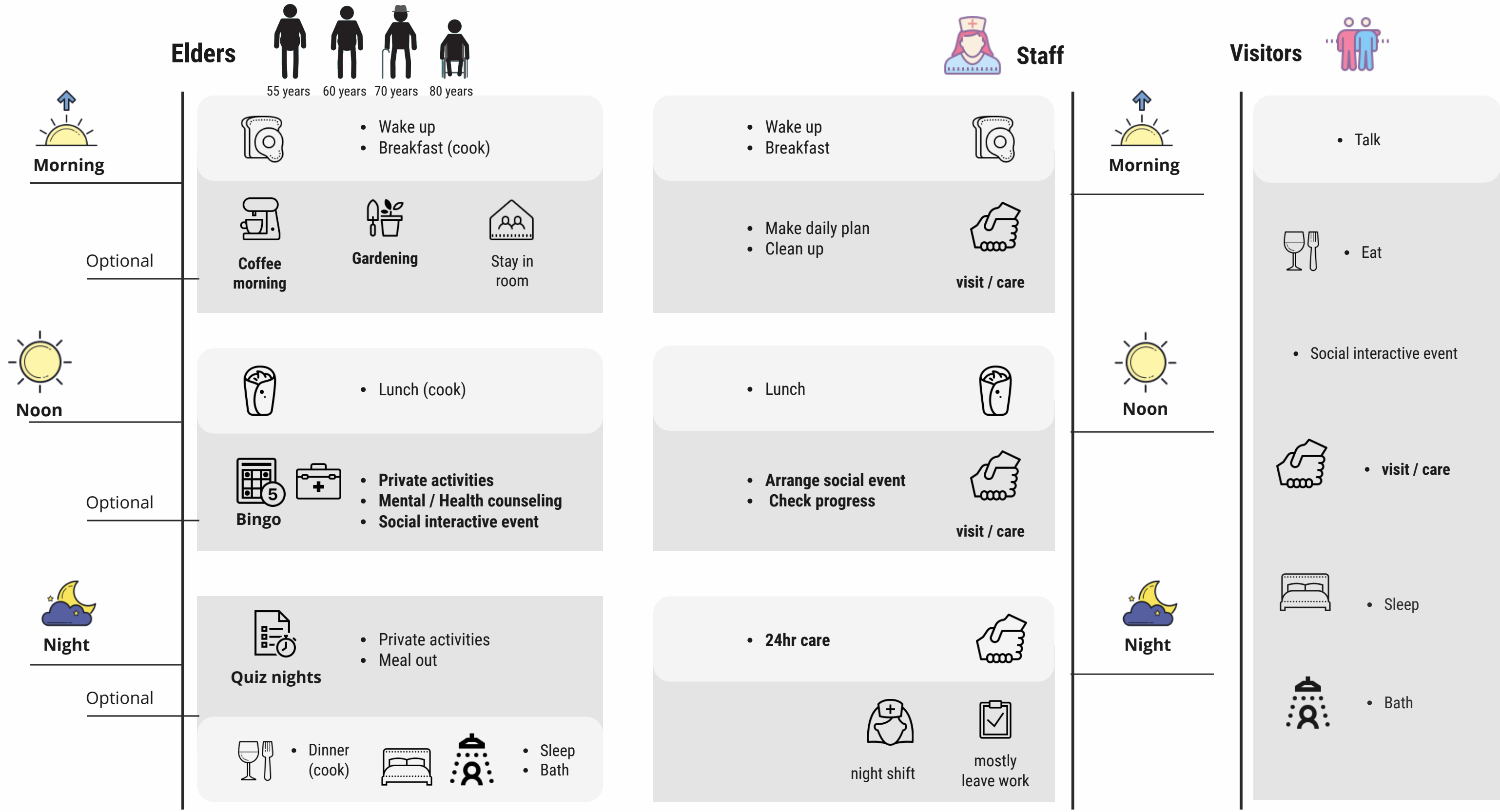
- improvement of providing assistance and bonding, **connection with elders.**

Summary

- **Belongingness** is the main factor that should be provided to inhabitants and **loneliness** is the main factor that drives the inhabitants to move in. As the result, the s**ocial events and space** for this need to be arranged to increase belongingness and overcome loneliness.
- The COVID-19 pandemic has limited **physical social interaction** therefore **digital** means of social interaction should be proposed without massively increasing energy consumption.

4.5 User Analysis

End user and staff



Summary

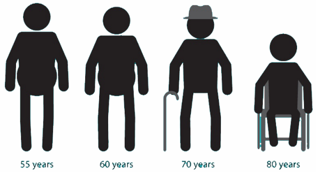
- There is **space for social activities indoors** but mainly outside needs to be improved.
- However, the **educational or learning activities** for over 55s' inhabitants are missing, As page 4.4 shows that **belongness and loneliness, interest and connecting to community** are important to the inhabitants.
- **Learning digital connectivity** can tackle those issues by having a **video call with family** or **attending online classes** to **develop their interests**. And this strategy can also be used during the **COVID-19 pandemic.**
- Whilst independent meal preparation should be encouraged, it does leave the potential for poor dieting, leading to unhealthy occupants and resulting in higher hospital omissions. Therefore, a carefully considered meal plan should be proposed which all of the end-users can adopt.

4.6 User Analysis

In Quinn et al., (1999) research about "Health characteristics of elderly personal care home residents", results showed that:

11% of the residents had diabetes,
43% had arthritis or rheumatism,
30% had hypertension,
42% had cognitive impairments,
43% had mental health conditions,
and 42% had some level of incontinence.

Over 55



	n	%
Marital status		
Never married	10	13
Married	11	15
Widowed	46	61
Divorced	8	11

(Quinn et al., 1999)

lived alone
small issue with independency (due to **disability, loneliness or long-term health issues, e.g. dementia or sensory impairments)**

End user

Physical well-being

The areas below indicate how certain design decisions can significantly improve the physical well-being of the end-user

- **Safety**
  easy access to help
  provide a better environment for care

- **Accessible**
  easy interface
  close proximity and distance
  assistant devices or components

- **Health condition**
  increasing the number of physical activities can enhance their physical health

- **Comfort (building condition)**
  better illuminance or daylighting quality
  air quality (outdoor fresh air, indoor air quality)
  quietness

Spiritual well-being

Although **dignity** was significantly related to both of the satisfaction measures, **spiritual well-being**, and **food enjoyment** were also significant positive predictors of elders' overall satisfaction with the nursing home. (Burack et al., 2012).)

- **Dignity**
  to have **own control** on their daily schedule (multiple choices)

- **Belonging** (to feel like home, social events)
  shared kitchen
  public dining space (family-style dining (Burack et al., 2012).)
  meaningful social event (Burack et al., 2012)
  reconnect with community
  outdoor common space for mixed usage

- **Recreation** (Wen, Albert, &VonHaaren, 2018)
  green space (gardening)
  outdoor exercise equipment
  encourage elderly people to perform Do-It-Yourself (DIY)

- **Relationship**
  staff
  neighbours
  family - interaction spaces when they visit
  visitors - private spaces for when they visit

4.7 Nutritional Research

THE EATWELL GUIDE BY NUTRITION UK (Cobiac et al., 2016)

The Eatwell Guide is a set of recommendations for the UK population to meet in regards to their nutritional values. It is important that a good nutritious diet is followed by the users of Whinn Dale in order to improve health to fight diseases and to also improve physical and mental wellbeing.

Table 1. Current and proposed recommendations used as constraints in the optimisation modelling (after Scarborough et al [4]).

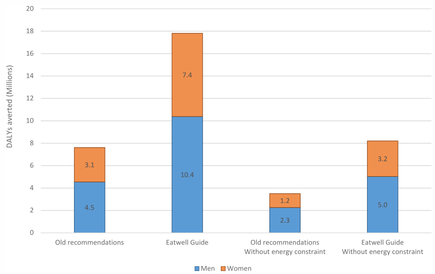
	Old recommendations	Eatwell Guide
NUTRIENTS		
Energy[1]	No increase in kcal	No increase in kcal
Carbohydrates	≥50% of energy	≥50% of energy
Free sugars	≤11% energy	≤5% energy
Fat	≤35% energy	≤35% energy
Saturated fat	≤11% energy	≤11% energy
Protein	≥14.5 & ≤15.5% of energy	≥14.5 & ≤15.5% of energy
Salt	≤ 2363 mg sodium	≤ 6g/2363 mg sodium
Fibre	≥ 23.5g AOAC	≥30g (AOAC)[2]
FOODS		
Fruits and vegetables[3]	≥5 portions a day	≥5 portions a day
Fish	≥ 2 portions a week (2*20g a day), one of which should be oily	≥ 2 portions a week (2*20g a day), one of which should be oily
Red and processed meat	≤70g/day	≤70g/day

NB. AOAC: Association of Official Analytical Chemists method for total dietary fibre analysis.
[1] Energy from foods and drinks, excluding alcohol.
[2] Equivalent 18g non-starch polysaccharide fibre
[3] Includes a maximum of: 1 portion of fruit juice; 1 portion of beans; 2 portions of smoothie. (Portion sizes: 30g dried fruit; 150mL fruit juice; 150mL smoothie; 80g all other fruits & vegetables)

The basic intake as seen above, was modelled in 2 dietery scenarios:

- If everyone changed from the current UK average diet to a diet that meets dietary recommendations that were in place before the SACN report of 2015 (the 'old recommendations' scenario);
- If everyone changed from the current UK average diet to a diet that meets dietary recommendations used for the new Eatwell Guide

The results of the study are as follows, with significant improvement to Disability Adjusted Life Years averted:



(Cobiac et al., 2016)

	Old recommendations	Eatwell Guide	Old recommendations Without energy constraint	Eatwell Guide Without energy constraint
Increase in life expectancy (months)				
Men	2.3 (2.0 to 2.6)	5.4 (4.7 to 6.2)	1.3 (1.0 to 1.6)	2.8 (2.3 to 3.4)
Women	1.6 (1.3 to 1.8)	4.0 (3.4 to 4.6)	0.9 (0.7 to 1.2)	2.0 (1.5 to 2.5)
DALYs averted (millions)				
Men	4.6 (4.3 to 4.8)	10.4 (10.0 to 10.8)	2.3 (2.1 to 2.5)	5.0 (4.7 to 5.4)
Women	3.1 (2.9 to 3.2)	7.4 (7.1 to 7.7)	1.2 (1.1 to 1.4)	3.2 (2.9 to 3.4)

NB. DALYs: Disability-adjusted life years. Values are means and 95% uncertainty intervals.

doi:10.1371/journal.pone.0167859.t004

	Current average intake, g/d	Change in intake*, g/day			
		Energy intake constrained		No energy intake constraint	
		Old recommendations	Eatwell Guide	Old recommendations	Eatwell Guide
Fruit and vegetables	**342**	↑ **58**	↑ **184**	↑ **57**	↑ **100**
Fruit	102	↑ 13	↑ 103	↑ 17	↑ 27
Fruit juice	63	↑ 1	↓ -31	↑ 2	↓ -8
Dried fruit	4.6	↑ 1	↑ 3.3	↑ 1.3	↑ 1
Vegetables	171	↑ 41	↑ 113	↑ 37	↑ 78
Potatoes, bread, rice, pasta and other starchy carbohydrates	**281**	↑ **54**	↑ **192**	↑ **56**	↑ **156**
Brown/wholemeal bread	33	↑ 15	↑ 50	↑ 11	↑ 37
White bread	49	↑ 2	↑ 19	↑ 10	↑ 24
Rice	27	↑ 1	↑ 1	↑ 3	↑ 7
Pasta	25	↑ 2	↑ 10	↑ 3	↑ 11
Potatoes	91	↑ 14	↑ 82	↑ 15	↑ 43
Cereals	8.3	↑ 2.7	↑ 2.7	↑ 3.7	↑ 13.7
Breakfast cereals, high fibre	20	↑ 8	↑ 32	↑ 7	↑ 18
Breakfast cereals, not high fibre	5.6	↑ 2.5	↓ -0.5	↑ 4.4	↑ 0.4
Dairy and alternatives	**221**	↓ **-24**	↓ **-48**	↓ **-15**	↓ **-27**
Milk	170	↓ -7	↓ -15	↓ -3	↓ -8
Cheese	17	↓ -12.8	↓ -14.4	↓ -10	↓ -16
Yoghurt	27	↓ -1	↓ -15	↔ 0	↓ -3
Beans, pulses, fish, eggs, meat and other proteins	**212**	↓ **-28**	↓ **-52**	↑ **3**	↑ **7**
Red meat**	35	↓ -22	↓ -27.3	↓ -10	↓ -16
Processed meat	33	↓ -16	↓ -25.8	↓ -12	↓ -22
White meat***	35	↓ -11	↓ -30	↓ -4	↓ -8
Oily fish	8.7	↑ 11.3	↑ 29.3	↑ 11.3	↑ 11.3
Whitefish	16	↑ 4	↑ 7	↑ 4	↑ 4
Beans, pulses and other legumes	14	↑ 11	↑ 12	↑ 9	↑ 19
Nuts	2.7	↑ 3.4	↓ -0.1	↑ 5.3	↑ 12.3
Foods high in fat and sugar	**216**	↓ **-3**	↓ **-113**	↑ **23**	↓ **-58**
Sugar sweetened beverages	120	↓ -1	↓ -61	↔ 0	↓ -21
Low calorie beverages	85	↔ 0	↓ -2	↔ 0	↓ -1
Cakes, confectionary and biscuits	71	↑ 5	↓ -40	↑ 18	↓ -49
Crisps and savoury snacks	6.1	↑ 3.9	↓ -0.1	↑ 5.9	↑ 12.9
Oils and spreads	14	↓ -9.6	↓ -8.5	↓ -4	↓ -7
Energy (kcal)	**1711**	**1711**	**1711**	**1926**	**1984**

*Change in comparison to the current average intake.
**Beef, lamb and pork,
***Chicken and other poultry

(Cobiac et al., 2016)

Figure 16: All images - Eatwell Guide

Summary

- The Eatwell Guide is an NHS and Nutrition UK set of recommendations for the UK population dietery requirements.
- It includes a new set of guidelines: less sugars and more fibre, 5 portions of fruit and vegetables daily, 2 portions of fish a week
- Of the total calorie intake: **50% carbohydrates, 5% sugars, 46% fats, 15% protein.**
- The guideline recommends a decrease in processed, red and white meats and an increase intake of oily and whitefish, beans, pulses, legumes
- Recommendation: a decrease in fruit juice and a simple increase in fruit and vegetables
- Recommendation: a decrease in breakfast cereals that aren't high in fibre and an increase in those that are
- Recommendation: a decrease in all dairy products
- Recommendation: a decrease in foods that are high in fat and sugar
- The Eatwell Guide has proven to enhance the life expectancy of the population of men by 5.4 months and women 4 months, if it were to be followed

4.8 Food Sector and Carbon Footprint

Food Sector Research

FOOD SECTOR EMISSIONS

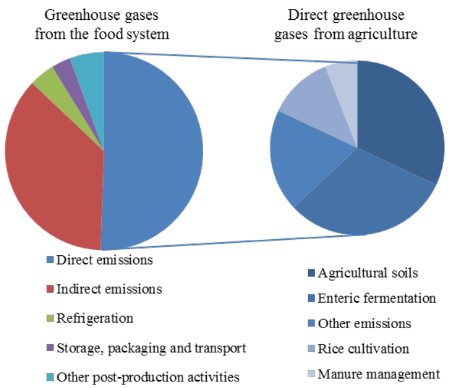


Figure 17: Emissions

Figure: Greenhouse gases emissions from the food system and direct greenhouse gas emissions from agriculture (data from CCAFS, 2013). Indirect emissions are caused by deforestation when new agricultural land is taken into production.

Highlighted in blue: The processes in which could be avoided through the use of allotments and food consumption based on the harvest

Pre-farm processes:
- Production and transport of inputs to the farm, most importantly feed and fertilisers, but also fuels, pesticides, growth substrates, pharmaceuticals, machinery, buildings, other capital goods etc.

On-farm processes:
- Soil emissions
- Emissions from enteric fermentation in animals
- Emissions from manure management
- Emissions from energy use on fields, in greenhouses, in animal houses etc.

Post-farm processes:
- Slaughtering
- Processing and packaging
- Storage and refrigeration
- Transport and distribution
- Retail and wholesale
- Preparation
- Digestion and waste disposal

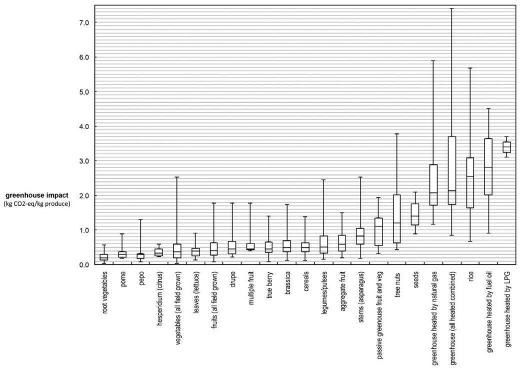
(Roos, 2013)

"17% of carbon dioxide emissions in the UK are linked to food. 11% of this is linked to transport." (Geography, 2020)

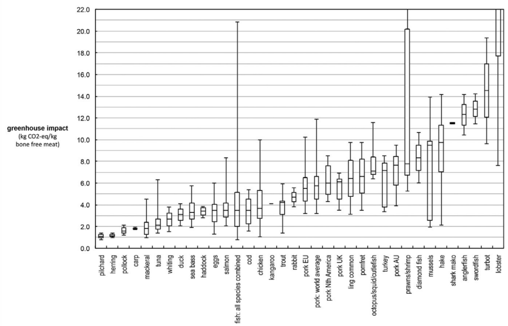
FOOD TYPE AND EMISSIONS

A study by Clune, Crossin, & Verghese (2017), completed a **Systematic review of greenhouse gas emissions for different fresh food categories**

They looked at the GWP (Global Warming Potential) of fresh foods to determine those with the highest.



Comparisons of synthesized GWP values across fruit, vegetables and staples classifications



Comparisons of synthesized GWP values (kg CO2-ew/kg bone free meat) for non-ruminant livestock (fish, poultry and pork)

Figure 18: Comparisons

Results from the study suggested that: **"Grains, fruit and vegetables had the lowest impact, with meat from ruminants having the highest impact"** (Clune, Crossin, & Verghese, 2017)

Summary

- **The food sector contributes 17% of UK carbon dioxide emissions**
- Poultry, fish and pork have a significantly higher global warming potential value than that of fruit, vegetables and staples
- Transport contributes a small amount of 11% UK emissions
- SYHA can actively contribute to reducing this by including an allotment which will avoid many of the processes that contribute largely to food sector emissions
- **SYHA can make important changes to the way they source, provide and consume food in order to reduce their carbon footprint**
- SYHA can reduce the consumption of meat for the users to benefit the environment and also the health of the user which has been recommended in the Eatwell Guide too.

Possible Solutions:

- Providing seasonal produce from the UK.
- Only allowing imported foods that cannot be grown in the UK and limiting which can be transported by aeroplane.
- Labelling the origin of food on menus so customers can make an informed choice as to what they eat.
- Providing food that has been produced locally e.g. from farmers' markets or farm shops.
- Growing food in the gardens or allotment
- Reducing the consumption of meat, dairy and fish

4.9 Green Infrastructure: Research

ALLOTMENTS AND COMMUNITY GARDENS

Figure 19: Allotments 1

Figure 20: Allotments 2

An individual/community garden
A plot of land made available for individual, non-commercial gardening or growing food plants
Plots are formed by subdividing a piece of land into parcels that are assigned to individuals or families

A community garden, however, is a single piece of land gardened collectively by a group of people.
Community gardens utilize either individual or shared plots on private or public land while producing fruit, vegetables, and plants grown for their attractive appearance

Figure 21: Allotments 3

Figure 22: Allotments 4

There are multiple types of community gardens:

- **Neighborhood gardens** are the most common type that is normally defined as a garden where a group of people come together to grow fruits, vegetables and ornamentals. They are identifiable as a parcel of private or public land where individual plots are rented by gardeners at a nominal annual fee.
- **Residential Gardens** are typically shared among residents in apartment communities, assisted living, and affordable housing units. These gardens are organized and maintained by residents living on the premise.
- **Institutional Gardens** are attached to either public or private organizations and offer numerous beneficial services for residents. Benefits include mental or physical rehabilitation and therapy, as well as teaching a set of skills for job-related placement.
- **Demonstration Gardens** are used for educational and recreational purposes in mind. They often offer short seminars or presentations about gardening, and provide the necessary tools to operate a community garden.

Including this will address...

- Issues of food security through **greater self-sufficiency** (very relevant as a benefit for SYHA)
- A response to **food price inflation**
- A desire to **reduce food miles**
- **Minimal travel time** - those who live within a 15-minute or less travel distance are more likely to visit a community garden as compared to those with a longer travel time (Blaine et al., 2016)
- Provides a **solution** for the loss of the traditional backyard
- A **cost effective strategy** for community renewal, empowerment and capacity building

Benefits for SYHA and the users:

- **Potential profit** for SYHA - through membership fees, sponsor for tools, seeds, or money donations
- Upkeep would generally be down to those involved in the gardening - **low maintenance** for SYHA and **sense of achievement** for the occupants
- Creates **healthy habits** for the users
- Increases both **availability and consumption of fresh produce**, fruits and vegetables for users, which means that a more nutritious diet is available - both cheaply and conveniently
- Avenue for regular and enjoyable **physical activity** (which is important during pandemics for example)
- The area is an ideal place for **recreation** with friends and relatives
- Creates **community spirit** and **larger conversation** amongst users with opportunities to bring individuals together around a commonly shared interest
- Allows a space for seed/vegetable swapping as well an avenue to start **a small market amongst the customers**
- Passers-by benefit, as does the environment at large
- Occupants learn of **environmental education**, sustainable urban agriculture, biodiversity and improved waste management and become more involved in the environment and their food
- Gardening or being outdoors provides **relief from stress** and **encourages creativity**, participation with nature and a sense of stewardship for the land
- The visibility of the gardens **attract attention** and open up opportunities for conversation and breaking down barriers between strangers
- Increased **satisfaction** of occupants
- **Demand for quality public outdoor recreation space grows due to COVID 19** - *emphasised through end-user research and also COVID research as an important theme in our project*
- Studies show that gardening decreases body mass index and lowers rate of obesity (Castro, Samuels, & Harman, 2013)

Summary

- Allotments and community gardens have potential benefits for both SYHA and the user
- Including **profit** for SYHA through membership fees, as a **low-cost climate mitigation strategy** which creates **greater self-sufficiency** and **reduces food miles**
- For the user, it is a way of creating **healthy habits**, providing access to **regular exercise** and **stress relief** whilst increasing the **availability of fresh produce** for a more nutritious diet
- There would be an **increased sense of community** over shared interest
- Links to the social infrastructure that was researched, and would be hugely beneficial to SYHA

1

IDENTIFY

2

3

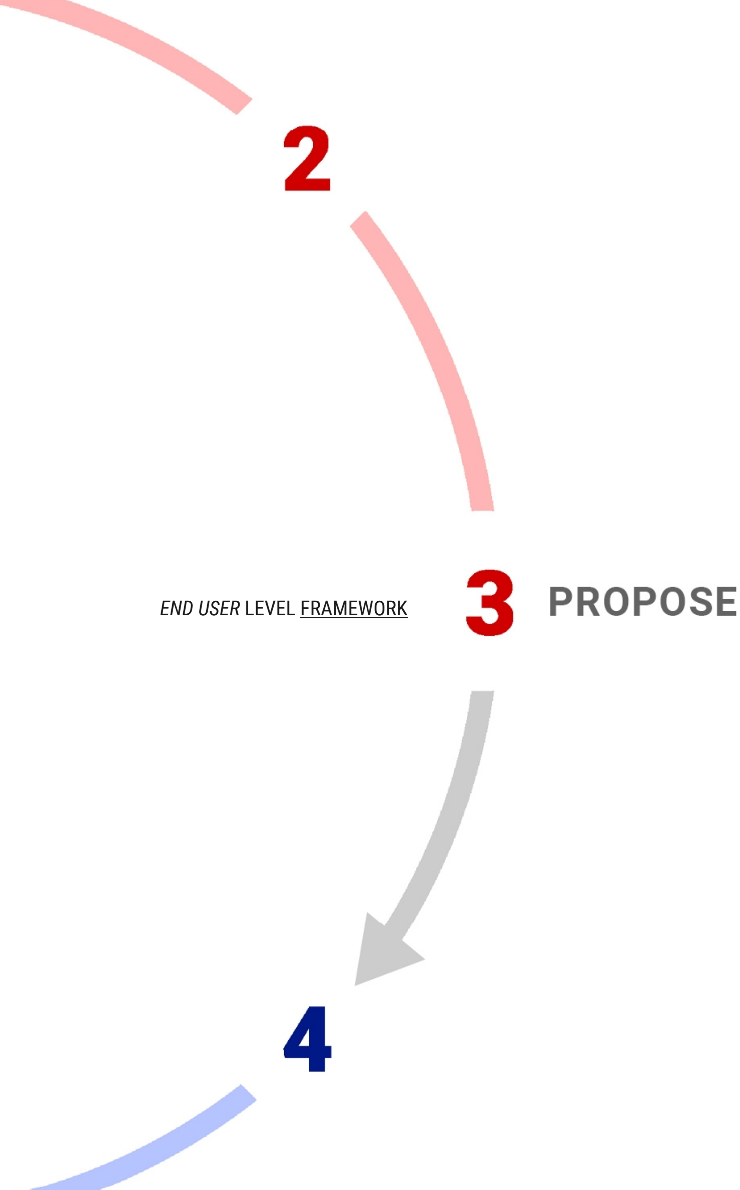
Element	*Factors that contribute towards high energy consumption levels*
Current Customers	Lack of digital performance monitoring
User Analysis	Lack of digital connectivity
Behaviour Analysis	• Poor dieting • Poor selection/ availbility of locally sourced foods • Lack of encouragement for using paperless activites

END USER LEVEL <u>FRAMEWORK</u>

SUSTAINABILITY FRAMEWORK

This page summarises the elements identified of the end-users that contribute to high levels of energy consumption.

The recommendations identified in the table provide a basic checklist for SYHA to adopt with their current customers



SUSTAINABILITY FRAMEWORK

This page outlines the proposals for the end-users to reduce their energy consumption. Each proposal will be explored in more detail throughout the next few pages.

The recommendations identified in the table provide a basic checklist for SYHA to adopt in their current housing stock.

Factors contributing towards reducing high emission levels	***Proposed means to reduce emissions***
Promoting activities for the end-user which have a minimum emission output but can still be enjoyed throughout the year	Providing seasonal activities which allow for the use of outdoor space where appropriate. i.e. Summer= BBQ, Spring/autmn= group walk, winter= inside events. This approach will limit emission intensive activities to just the winter
Promoting a healthy lifestyle can delay the dependency on energy intensive services that people who are living longer may require	Enhance the behaviour of end-users and staff by providing weekly healthy menus
Limiting loneliness as it can increase energy usage through connectivity via technology	Encourage communal meals and evening spent together. Connectivity via technology to be reduce to the event of a pandemic/lockdown
Increasing the availability of locally sourced foods	Propose meal plans which allow for locally sourced foods to be used. As opposed to foods which rely on high transport demands

5.1 Social Infrastructure

Social Infrastructure

MEANINGFUL SOCIAL CONTACT

Researches of interrelationship in residential facility(especially care home) has shown the important influence of **social relationships** in **older age** on the **health** dimensions of the quality of life including **life satisfaction** and **emotional, subjective**, and **psychological wellbeing** (Cutrona et al. 1986; Holmen et al. 1994; Lee and Ishii-Kuntz 1987; Lee and Shehan 1989; Nussbaum 1983; Revenson and Johnson 1984; Traupmann et al. 1992). Older people have **identified social relationships** and **social contacts with family and friends** as important influences upon their quality of life (Bowling 1995; Farquhar 1995); and **peer relationships** are perceived as vitally important in the aging process.

ACTIVITY

The most popular activity among the residents is **talking**, and the most common conversations centre on their feelings about living in the facility (Gutheil 1991).

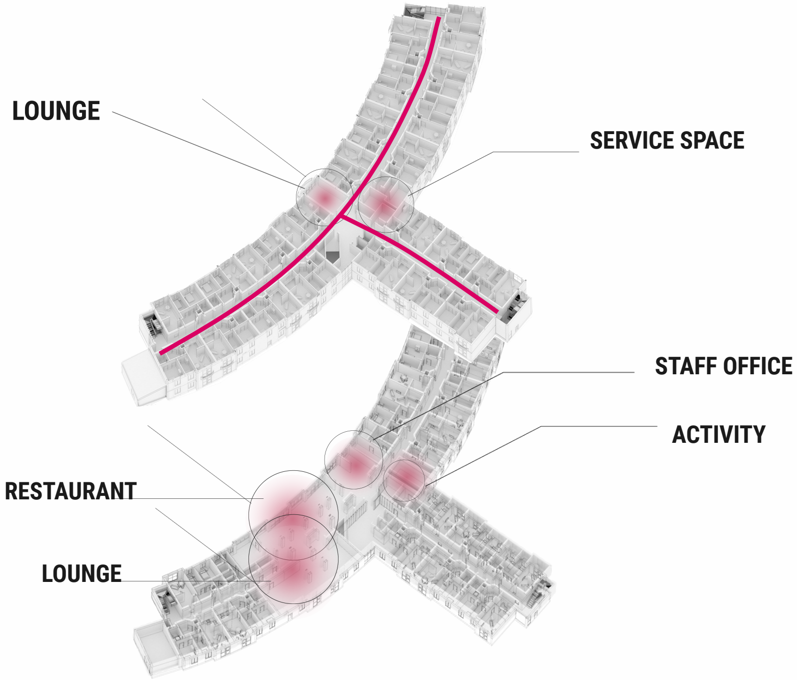
People are encouraged to participate in activities like **gardening, handicrafts, games, walks** or bird watching and, in this way, continuing some of the most **inspiring everyday activities.**

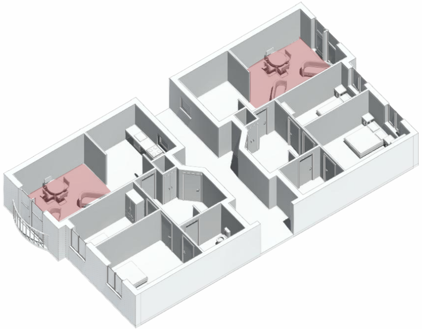
The importance of food and the **dining experience** have been staples within many culture change models. Some changes advocated for include **family-style dining instead of tray service**, increased choice in food options, and greater access to food at all times of the day. (Burack et al., 2012)

During pandemic, can not maintain the **face to face socialising**. Therefore, a proposal for SYHA to implement is to provide each tenant with a personal laptop. In case end users do not know how to use the laptop, an **instruction sheet** will be provided. In addition, any physical activities will be moved online using Zoom to include all customers can still enjoy social interaction.

Summary

- Increase space for end-user for **chatting**, handicrafts and **social interaction**.
- Improve the **dining experience**, have a **shared dining room** (family-style dining) instead of tray service.
- In the event of a **pandemic**, the **digital connectivity** is a sustained way to of **socialising for all inhabitants.**





most of the activity happening in their **living room.**

Through digital connectivity to keep socialising for all inhabitants during the pandemic.

5.2 Allotment Schedule Proposal

Allotment Schedule

	Plant	Plant in greenhouse	Harvest	Allotment Jobs	Recipes based on the harvest and nutritional research
January	Shallots, garlic, leeks,	tomatoes, aubergines, onions	parsnips, swede, winter radish, carrots, celeriac, winter cabbage, brussel sprouts, celery, kale, leeks	order seeds, clean up the plot and dispose of all of the damaged and rotten crops, dig over, lime and manure the soil, collect compost	creamy leek and potato soup, roasted carrot and butternut squash couscous, brussel sprout caesar salad, mushroom and cabbage ramen, celeriac mash with salmon, chunky vegetable soup
February	broadbeans, parsnips, jerusalem artichokes, shallots, gooseberries, currants	feltham first and meteor peas, lettuce, rocket, spinach, radish, turnips, onions, aubergines, chillies, peppers, tomatoes	purple sprouting broccoli, Brussels sprouts, Beet leaves, chards, kale, chicory, endive, parsnips, swede, celeriac, scorzonera, leeks, celery, jerusalem artichokes	Top dress all of the fruit trees, fruit bushes and land with a general fertiliser, pruning, clean the greenhouse, dig over the soil if not completed in january, wash out seed trays and pots, continue to collect compost	creamy leeks and buttterbeans, tofu and greens thai stew, kale and chickpea curry, broccoli quiche, winter slaw with chard, endive and celery, sweet potato curry, sweet potato tacos, kale pesto pasta, artichoke pasta, beetroot hummus
March	onions, shallots, leeks, asparagus, kohl rabi, potatoes, beetroot, radish, parsnips, jerusalem artichoke, broad beans, early peas, brussels sprouts, turnips, lettuce, spinach Beet, raspberries, cane fruits	tomatoes, peppers, aubergines, cucumbers	spinach beet, chards, kale, Brussels sprouts, winter cauliflowers, swedes, scorzonera, leeks	Complete any unfinished digging and winter pruning, clean up the ground in between the plants before giving them a top dressing of a general fertiliser, sow seeds	cauliflower cheese, cauliflower tacos, sri lankan beetroot curry, asian brussel sprouts and cashews, kale and mushroom quiche, beetroot and swede salad, roasted swede, kale and black eyed peas with paprika, shitske and chard miso soup
April	beetroot, radish, peas, broad beans, french beans, broccoli, brussels sprouts, cabbage, cauliflower, kale, chard, spinach, rocket, lettuce, kohlrabi, asparagus, leeks, onion, shallot, globe artichokes, jerusalem artichokes, sweetcorn, strawberries	aubergine, celery, outdoor cucumbers, outdoor tomatoes	chards, early radishes, greenhouse potatoes, fast lettuces, spring cabbage, broccoli, very early peas	Prepare seed beds for outdoor sowing of main crop vegetables next month,, mostly planting, harvesting	Rainbow Chard Barley Salad with Ginger Tahini Dressing, pickled radishes, New Potato, Rocket and Radish Egg Salad, radish and mint pasta, vegetable tray bake, curried potatoes, potato and fish cakes, cabbage fritters, pulled jackfruit burgers with salad, roasted potato,cabbage and lentil salad.
May	french beans, runner beans, peas, broccoli, calabrese, cabbage, cauliflowers, chicory, kale, lettuce, rocket, kohlrabi, turnips, swedes, beetroot, radish, spring onions, courgette, marrow, pumpkin, squash, sweetcorn, strawberries	aubergine, peppers, chillies, cucumber, tomatoes	lettuce, kale, spring onions, fast growing radish, winter cauliflowers, spring cabbage, sprouting broccoli, asparagus	cultivation jobs: hoeing and thinning out, sowing, planting, harvesting, look out for pests and diseases	coleslaw, Golden Rice with Kale and Harissa Chickpeas, Warm Cauliflower & Kale Salad, Beetroot & Cauliflower Kale pasta with Pesto Dressing, lentil soup with vegeatbels, Ribollita With Poached Eggs, Spiced Mung Beans Casserole, kale canelloni, Cabbage & Carrot Fritters, sweet and sour cauliflower
June	french and runner beans, maincrop peas, beetroot, carrots, turnips, swedes, chicory, endive, kohlrabi, sweetcorn, squash, courgette, marrows, broccoli, calabrese, brussels sprouts, summer cabbage, cauliflower		apples, currents, berries, blackberries, beetroot, radish, broad beans, early peas, cabbage, cauliflower, rhubarb, spring onions, spinach, lettuce	watering, weeding, cultivation: hoeing and thinning out, pest control, planting, harvesting	coleslaw, blackberry and apple crumble, minty peas, rhubarb tart, jams, beetroot hummus, Beetroot, Sweet Potato,, feta. Orange & Pistachio Salad, Vegan Pasta Primavera with Watercress & Almond Pesto, Quorn Hotpot, Pan-fried Gnocchi with Creamy Spinach and Mushrooms, spinach dahl.
July	spring cabbage, chinese cabbage, overwintering cabbages, chicory, lettuce, kale, radicchio, kohlrabi, peas, french beans, beetroot, carrots, radishes, turnips, apples, pears, plums, marrow, pumpkins, squashes, leeks		globe artichokes, potatoes, garlic, shallots, tomatoes	watering, weeding, cultivation: hoeing and thinning out, pest control, planting, harvesting	greek salad, new potato salad, potato pepper and courgette curry, carrot cake, spiced carrot and orange soup, tandoori chicken, summer slaw and yoghurt dressing, panzanella, pickled radish and vegetable slaw, cheese and tomato muffins, salmon and watercress quiche, artichoke pizza, creamy artichoke dip, spinach articchoke and cheese melt on toast, Eggs in Purgatory with Artichoke Hearts, Potatoes, and Capers
August	spring cabbage, chinese cabbage, savoy cabbage, cauliflowers, radishes, turnips, spring onions, kohlrabi, spinach,		runner beans, climbing and dwarf beans, potatoes, onions, plums, damsons, raspberries	summer pruning, fertilising, pest control, cultivation, planting, composting, watering	Red pepper and sundried tomato fritters, Red pepper and sundried tomato fritters, vegetable and coconut curry, potato gratin, broccoli and cheese filo pastry, Moroccan roasted cauliflower curry, courgette chilli and mint salad, pumpkin chard feta and almost crumble, blackberry and apple scone, raspberry and plum tart, cauliflower cheese gratin, Runner bean tortilla with tomato salad, Green bean mac 'n' cheese
September	oriental vegetables, spring onions, winter lettuce, spinach, turnips		onions, spring onions, leeks, potatoes, radishes, turnips, beetroot, carrots, apples, pears, green tomatoes, tomatoes, strawberries, sweetcorn, marrows, courgettes, pumpkins, aubergines, spinach, lettuces, kale, cabbage, cauliflowers, globe artichokes, kohlrabi, cucumber, runner beans, french beans, peas, chilli, sweet peppers	summer pruning, hanging wasp traps, pest control, fertilising, composting	beetroot carrot and spring onion fritter, roasted beetroot and kale quiche, parsnip and apple soup, spiced toffee apple cake, ratatouille, Mushroom and beetroot rolls, Lemon and oregano chicken skewers, Vegetable tagliatelle Alfredo, cottage pie, Vegetable tagine, lavender shortbread, fish pie, sweet potato and cauliflower curry pies, enchiladas, burritos, Mexican dishes, Greek salad,
October	winter broad beans, peas, beetroot spinach, chinese cabbage, japanese onion sets, garlic, onion, rhubarb crown		potatoes, carrots, scorzonera, salsify, celeriac, drumhead cabbages, green tomatoes, pumpkins, marrows, squash, peas, runner beans, early leeks, chard, spinach, lettuce, oriental vegetables, fennel	composting, harvesting, cultivation, small amount of digging over where necessary, clean greenhouse to allow winter light in	mustard and mushroom one pot, vegetable tagine, ramen bowl, roasted pumpkin with mushroom leek and stilton, Curried celeriac, red cabbage, pear and walnut coleslaw, Whole baked cauliflower with pearl barley and wild mushrooms, quinoa risotto with pumpkin and spinach, fig pear and goats cheese salad, pear and banana bread, baked butternut squash and rice, veggie kebabs, fennel and roasted tomato pasta, ramen noodles
November	garlic, broad beans, peas, winter lettuces, fruit trees		leeks, brussels sprouts, winter cabbages, cauliflower, kale, spinach, carrots, celeriac, turnips, swede, celery, kohlrabi,	digging over, raking leaves for a leaf mould stack, spread manure, harvesting	roast dinner, celeriac mash potato, roasted Moroccan cauliflower curry, winter slaw, Asian slaw, celeriac soup, Teriyaki root vegetable salad with crispy tofu, Baked celeriac with smoked trout and caper salsa, Hearty wholewheat pasta with Brussels sprouts, cheese and potato, Apricot, chestnut and aduki balls with roasted vegetables and white wine miso gravy, Kale and quinoa salad with orange tahini dressing
December	garlic, onions		kale, perpetual spinach, chicory, endive, cabbage, cauliflowers, brussel sprouts, leeks, potatoes, carrots, parsnips, swede, scorzonera, celeriac, winter radish, turnips, jerusalem artichokes, kohlrabi	tend to the tools, pest control, plan the year ahead and order seeds, repair and renovate where necessary, attention to compost and bins	egg fried rice, bubble and squeak, okonomiyaki, Coconut, turmeric and yellow split pea soup, Huevos rancheros, mushroom and parsnip rosti pie, vegetable fritters with spiced coconut chickpeas, Spicy mushroom lasagne, vegetable noodles, casserole with dumplings, cottage pie, almond lentil and vegetable stew, vegetarian lentil bolognaise, confit turnips with mushroom consomme, swede mash

root vegetables
capsicums
fruit
cruciferous
fresh beans and peas
leafy greens
other
edible plant stems
marrows
allium

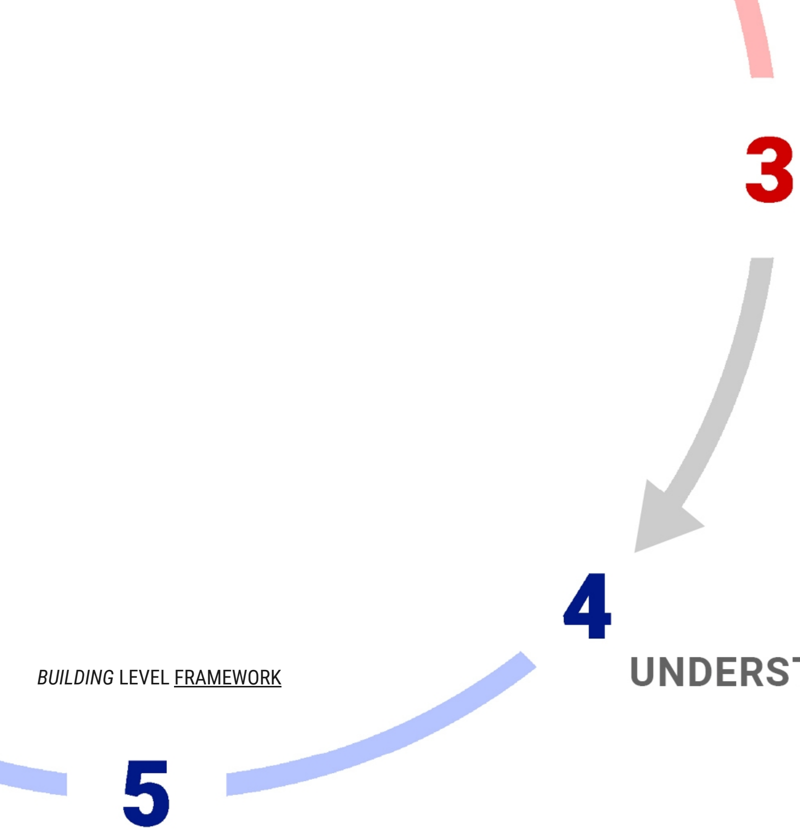
(National Allotment Society, 2021; BBC Food, 2021; National Trust, 2020)

Summary

- The **specific jobs** on the allotment that must be completed are understood in the table
- **Seasonal recipes** are understood as a result of the **harvesting period** and based off of the previous research on **carbon emissions** relating to the food sector and **dietary requirements**
- Users can integrate their use of the allotments into their **dining experience** and also provide some pride to take care of the land around them.
- **Provides an opportunity for composting and waste management**
- The site logistics of the proposed allotments will be explored during the 'building' chapters of this project.

SUSTAINABILITY FRAMEWORK

Now that the end-user has been analysed, understood and measured proposed to reduce their energy consumption, the same exercises will now be proposed for the building. Starting with understanding the building's performance in relation to energy consumption



UNDERSTAND

BUILDING LEVEL FRAMEWORK

6.1 Macro-climatic Analysis

Köppen climate classification

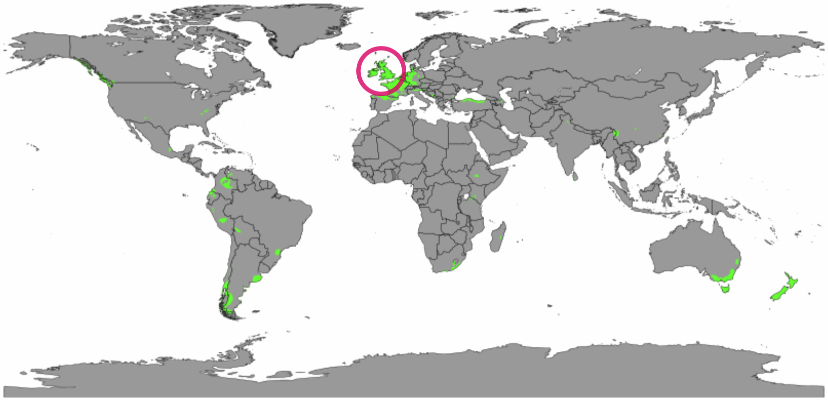
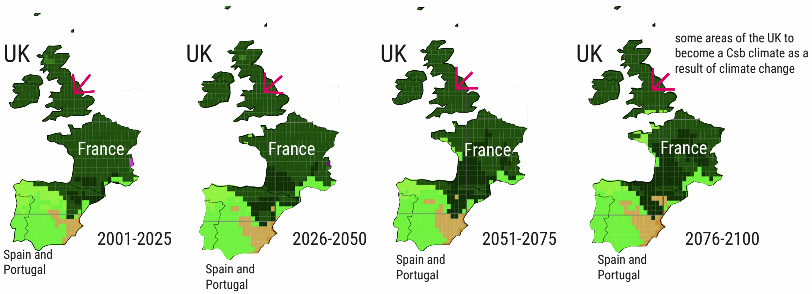


Figure 23: Map

United Kingdom future climate changes

Figure 24: Future Maps



The Cfb climate

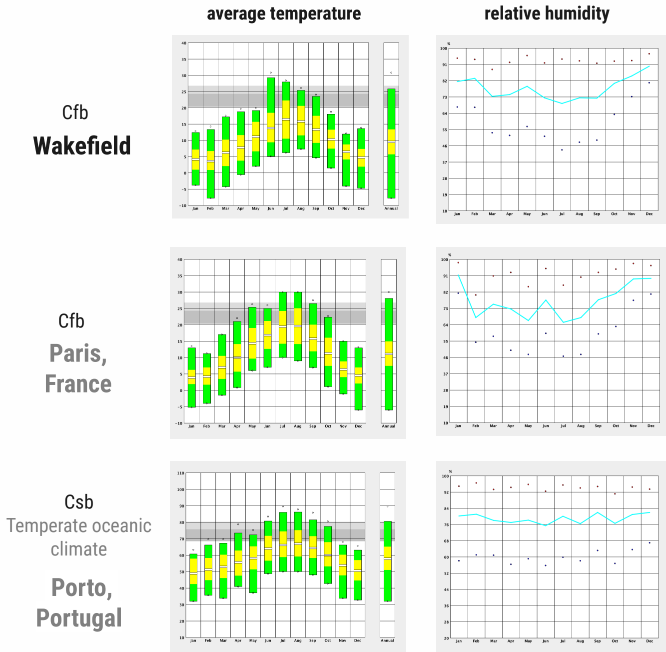
Temperate oceanic climates, also known as **"marine mild winter"** climates or simply oceanic climates, are found either at middle latitudes or confined to narrow bands of territory, largely in mid or high latitudes. They are often found on or near the west coast of continents. In addition to moderate temperatures year-round, one of the characteristics is the **absence of a dry season**.

In the UK, on average, the temperature variations in the year are between 10–15 °C, with average annual temperatures between 7–13 °C. Rain values can vary from 50–500 cm a year and strong storms are rare.

Similar Cities

As the climate in Wakefield and most of the UK will remain a Cfb climate until 2100, Paris' climate was analysed as it is also Cfb however has a different latitude closer to the equator. Due to some areas of the UK becoming a Csb climate, Porto was selected as a case study for this where temperature and relative humidity were looked at for a comparison.

Figure 25: Climate Consultant



Summary

- United Kingdom climate classification is **Cfb** in 2001-2025 and predicted to stay **Cfb** in 2051-2100.
- Average temperatures may increase as a result of climate change.
- Small annual temperature change and rare strong storms suggest that a building's design **should not focus** on extreme conditions and fluctuations

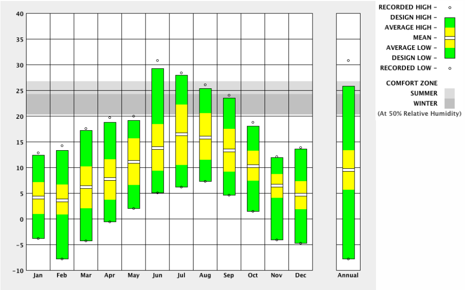
6.2 Macro-climatic Analysis

Climate Analysis

Wakefield sits in a **Cfb climate zone** and will remain this category in 2100, it is located in the north of England in South Yorkshire.
Latitude and longitude of Wakefield 53.693752869777995, -1.4132974789575952
Wakefield is **30m above sea level**. The climate is **warm** and **temperate**. There is significant rainfall throughout the year in Wakefield. Even the driest month still has a lot of rainfall.

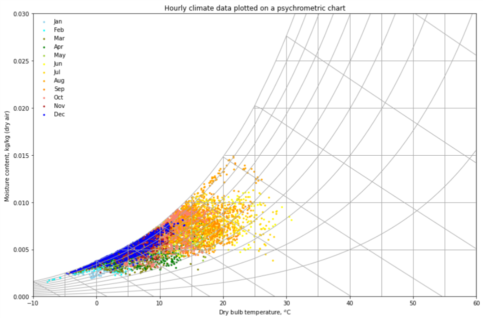
Figure 26: All images - Climate Consultant and Rainy Days

Average Temperature



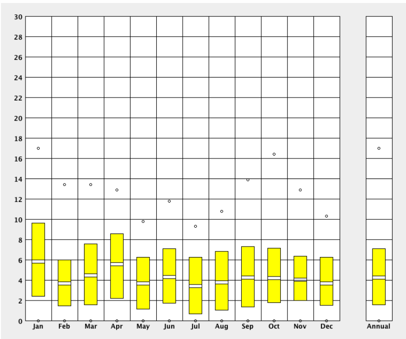
Highest average temperature: 29℃ (June)
Lowest avergae temperature: -7℃ (February)
Average annual temperature: 6℃ to 14℃
Comfort zone is 20℃ to 24℃; only July's average high temperature is in the comfort zone.

Relative Humidity



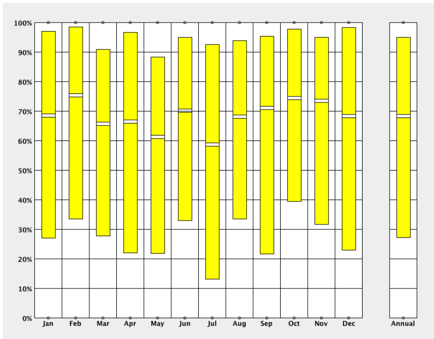
Humidity is high in this micro-climate in a range of 60-100%. Humidity is lowest during the month of June and July when temperatures are higher than average. This is above the 40-60% relative humidity as stated by the WELL standard in page 2.5

Wind Velocity



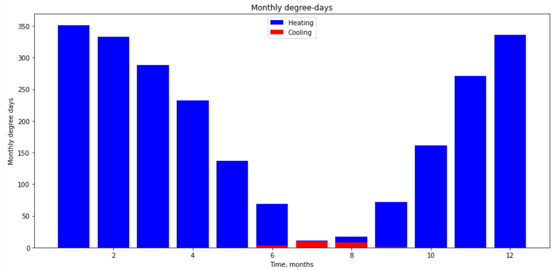
Average annual high wind velocity: 7m/s.
Average annual low wind velocity: 1.8m/s.

Sky Cover Range



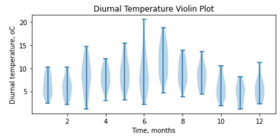
Average annual sky cover range: 69%

Monthly Degree Days



Degree days are a measurement designed to quantify the demand for energy needed to heat or cool a building. In Wakefield, heating is dominant year round except for some summer months.

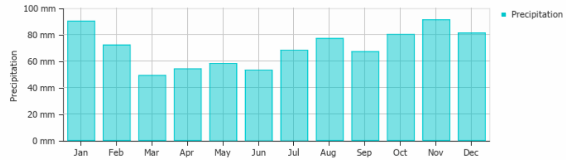
Diurnal Temperature



Rainy Days and Precipitation

The annual rainfall is 809 mm

January	February	March	April	May	June	July	August	Sep-tember	October	November	December
10	9	9	10	10	10	10	10	8	10	10	10

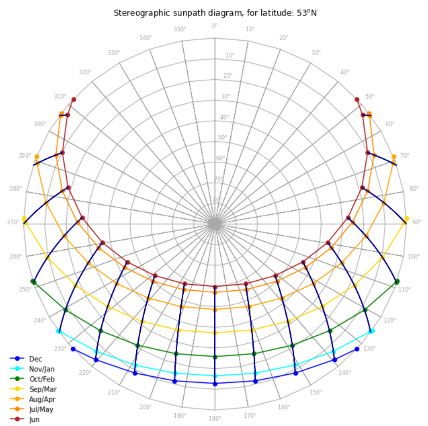


Summary

- Wakefield's temperature averages **9.5℃** every year
- With **highs of 29℃** and **lows of -7℃**
- **Precipitation** is high all year round with an average of around **60mm** each month.
- **Relative humidity** is very high at **60-90%** all year round. A relative humidity should be between 40-60% to help reduce the transmission of COVID-19. Therefore, the building level proposal should look to decrease the relative humidity
- For **69%** of the time the sky is **overcast**.
- **Heating** is the predominant demand all year, except for the month of July, due to the year temperature being below the comfort zone.

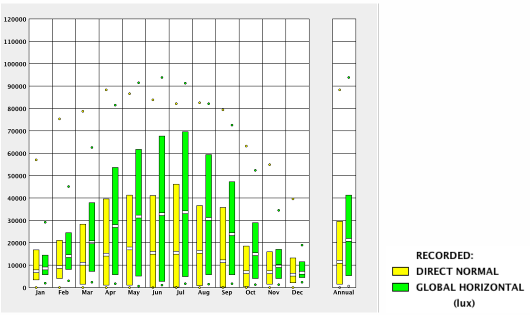
6.3 Micro-climatic Analysis and use of Renewables

Sun Path Diagram



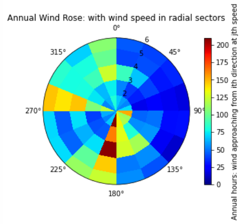
At a latitude of 53°N the sun rises in the east at 8:30am in December and 3:30am in June. The sun sets at 3:30pm in December and 8:30pm in the summer.

Illuminance range

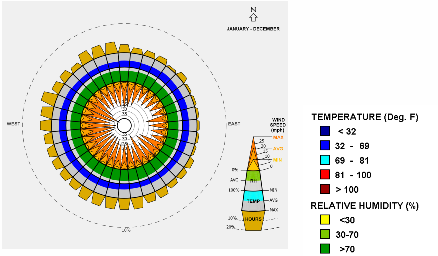


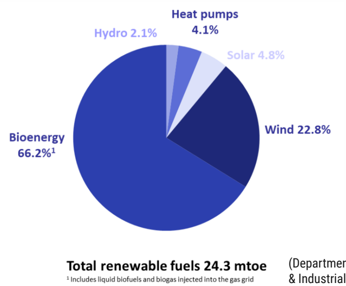
Illuminance (direct normal) is highest in the months of May, June and July averaging between 3000-4000 lux. It is incredibly low in the winter months averaging 500-1000 lux.

Wind Wheel



Winter
Predominant wind direction: South, West, North West
Wind speed highs: 35 m/s
Wind speed lows: 2 m/s

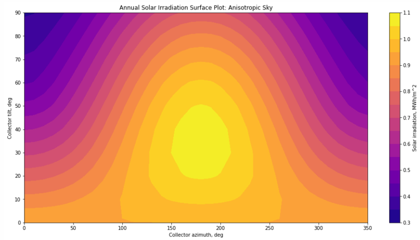




(Department for Business, Energy & Industrial Strategy (BEIS), 2020)

A site needs an annual average wind speed of over 5 m/s to be productive and preferably more than 6m/s. An estimate of 5m/s at 10m above ground level might well be 6m/s at 25m above ground level (Hughes, 2012). Although wind turbines might be a plausible on-site energy solution, priority has been given to allotments to grow on-site foods. Therefore, wind turbines will not be used as they take up valuable space.

Solar Irradiation Surface Plot



PV solar panel collector : (Y) angle and (X) orientation

Renewable energy production by source in the UK in 2019 shows that Bioenergy was the largest contributor and the second was wind split equally by on and off-shore wind.

Figure 27: All images - Climate Consultant and Pie Chart

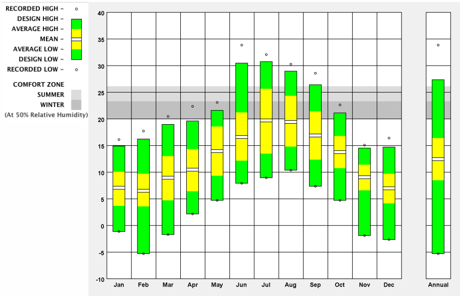
Summary

- Wakefield experiences significantly **low** amount of **illuminance** and **daylight hours** in the winter which is an large contrast to the summer months, meaning more dependency on artificial lighting.
- The illuminance is high in the summer, meaning **more glare, higher use of blinds,** more therefore **artificial lighting**
- The **wind direction** is predominantly **south and west** and doesn't often fall below 4 m/s. Winter and fall are the windiest months, as half the time, the wind speeds are **uncomfortable** for the user.
- Solar power will be less efficient in winter due to the sun hours, and the angle of the collector, however, is the **most plausible solution for renewable energy production.**

6.4 Future Climate Predictions 2080

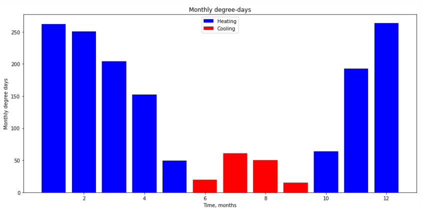
Climate Analysis

Temperature Increase



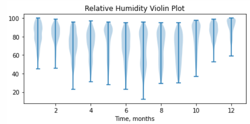
Highest average temperature: 32℃ (July), **2℃ increase**
Lowest average temperature: -5℃ (February) **2℃ increase**
Average annual temperature: 8℃ to 17℃, **3℃ increase**
Comfort zone is 20℃ to 24℃; June, July, August, September average highs are in the comfort zone **(3 more months)**

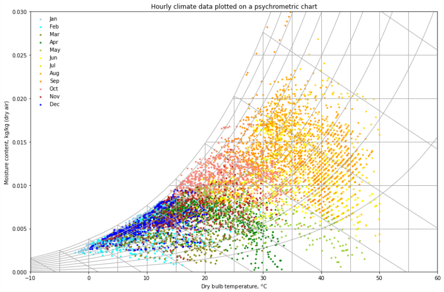
- Research shows that in Britain, the temperatures have a potential to rise by **5-20%**
- In Britain, the average temperature is estimated to **rise by 2°C to 3.5°C** by 2080.
- **"Very hot August"** with average temperatures **3.4°C above normal** will occur 3 out of every 5 years by 2080.
- Greater night-time than day-time warming in winter and greater day-time than night-time warming in summer.
- Much warmer, drier summers will lead to water shortages and reduced crop yields (Hulme & Tyndall Centre for Climate Change Research, 2002)



Significant **increase in cooling degree days** (CDD) and **decrease in heating degree days** (HDD)

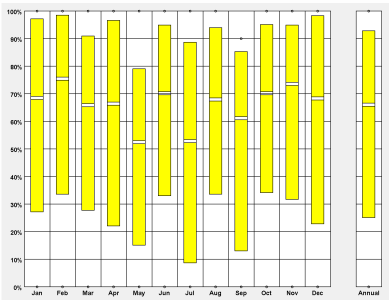
Relative Humidity





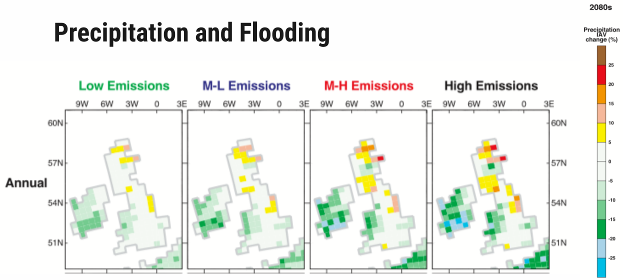
Humidity in 2080 is much lower within the range of 20-90% meaning a large shift from 60-100%. Humidity is lowest during the months of April, May and June dropping below 10% at times and highest during the winter.

Sky Cover Range



Average annual sky cover range: 67%, **2% decrease,** ***higher cloud cover in winter and lower in summer*** meaning more radiation in summer and less in winter

Precipitation and Flooding



- Precipitation in a high Emissions scenario may **decrease in summer by 50%** by the 2080s and **increase in winter by up to 30%**
- Summer soil moisture by the 2050s may be reduced by about 30% over large parts of England for the High Emissions scenario, and by **40% or more by the 2080s. I**deal moisture content level in soil usually depends on the type of soil used, with the ideal ranging from 10-45% for growing food/crops (Brandt et al., 2017). This would have an impact on the types of vegetation grown, the success of certain species and success of the green infrastructure proposal. Therefore this must be considered as a risk in our proposals.
- Huge **increase in storm surges** are likely to occur
- The surges are most damaging when they occur at high tide; resulting in **regular flooding** around much of the UK coast. This would have detrimental impacts on the user, for example, risk to public health by the end-users displacement into temporary accommodation which might not be as covid safe or damage to their property and possessions.
- Subsidence is causing the ground level to fall all over the UK, specifically in Yorkshire by **0.5mm/year**

Sea Level Rise

- Global average sea level may rise between **9 and 69cm** by the 2080s, resulting in higher flooding possibility as Wakefield sits at an elevation of 30m

Figure 28: All images - Climate Consultant and Precipitation and Flooding

Summary

- The rise in temperature will lead to **overheating and heatwaves.**
- Increasing **precipitation and storms** in winter and spring will create a high flooding possibility.
- There will be **less sunlight and radiation in winter** and **more sunlight and radiation in the summer** as a result of changes to cloud cover
- There will be significant sea level rise of a potential **9 to 69cm by 2080.**

6.5 Government and Local Council Commitments

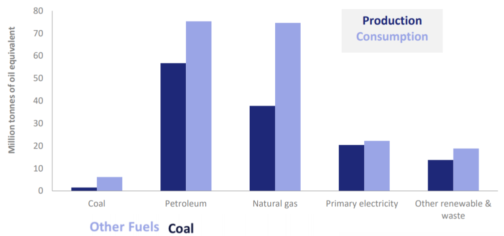
Figure 29: UK Climate Change Conference

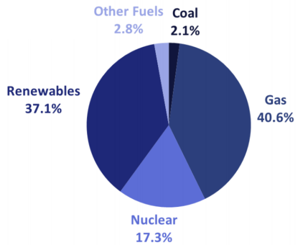
UK GOVERNMENT TARGETS AND LAW (Hulme & Tyndall Centre for Climate Change Research, 2002)

- The UK government is hosting the **26th UN Climate Change Conference of the Parties (COP26)**
- As a result of this they have passed laws to achieve to bring all greenhouse gas emissions to **net zero by 2050**.
- **Local councils, regional councils** and **companies** are then required to act in accordance to this(Government UK, 2020)

CURRENT UK POSITION (Department for Business, Energy & Industrial Strategy (BEIS), 2020)

Chart 1.2: Production and consumption by fuels 2019





Gas is of the largest used energy sources at **40%** in the UK from 2020 statistics. **Renewables are 37%** of the sources, which is **predicted to rise as the largest contributor.** The graph shows in green the zero carbon energy production and the red represents cabron intensive energy generation in the UK.

Figure 30: ofgem logo

Ofgem – the Office of Gas and Electricity Markets: is the government regulator that oversees the energy system in Great Britain.
The strategies relevant to our project in which they are implementing to achieve net zero carbon by 2050 are as follows...

- *Encourage more options in the way people use electricity, for example charging electric vehicles at night and selling the power stored in car batteries back at peak times*
- *Enable drivers to go electric by supporting an energy network that can power 10 million electric vehicles by 2030 (Ofgem, 2020).*

Figure 31: northern power grid logo

(Northern Power Grid, 2021)

COMMITMENTS (Northern Power Grid, 2018)
- **Dacarbonisation** of generation: less coal and more wind and solar are being used to power our homes
- **Decentralisation** of energy sources

STRATEGIES (Northern Power Grid, 2020)
- To facilitate the charging infrastructure and grid capacity to enable the growth of **Electric Vehicles**
- The growth of low-carbon technologies, such as solar PV and electric vehicles, could see a rapid increase in demand on Low Voltage (LV) networks.

Figure 32: northern gas networks logo
(Northern Gas Networks, 2021)

COMMITMENTS (from the Energy Networks Association)
- **Carbon capture, utilisation and storage:** will provide negative emissions when combined with bioenergy technologies
- We must recognize that existing trees have already captured carbon and therefore must not be cut down and employ strategies that increase the use of carbon capture in our green infrastructure proposal

COMMITMENTS (from Northern Gas Networks)
- To make **50% of vehicles low emission** or hybrid by 2026 and provide EV charging

Figure 33:Wakefield council logo

(Wakefield Council, 2020)

Wakefield Council: Action Plan

Targeting **2030** to become carbon neutral
Aim: To self-generate our own renewable clean energy and embrace technologies to store and utilise any excess power that is generated.
Project 1: Energy parks
Project 2: Rooftop solar PV (this is a strategy SYHA can use as identified in the climate analysis)
Project 3: Green gas (become part of the Green Gas Certification Scheme)

(Spereall, 2021)

Energy Parks
This project focuses on identifying suitable parcels of land and renewable technology systems that can be used to self-generate clean power to cover the council's corporate electricity needs. It is in short a farm/plot of land dedicated to renewable energy technology to produce large scale electricity.

(National Grid, 2021)

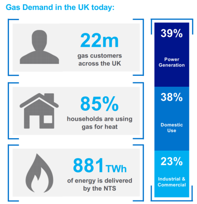


Figure 34: National Grid

In the UK, the National Grid ESO (SYHA's Electricity System Operator) will be able to operate a zero-carbon system by 2025

COMMITMENTS
- **Achieve net zero by 2050**
- **Reduce Scope 3 GHG emissions** for the electricity and gas we sell to our customers (making up 80% of our Scope 3 emissions) **by 20% by 2030** from a 2016 baseline
- **Reduce SF6** emissions from our operations **50% by 2030**
- One of the Principal Partners in the **COP26** and committed to the **UN Sustainable Development Goals**

AMBITIONS
- Accelerate our **net zero target** wherever possible.
- **Eliminate all SF6** gas from our assets by 2050
- Further **reduce our Scope 3** emissions
- In the UK, the National Grid ESO (Electricity System Operator) will be able to operate **a zero-carbon system by 2025**

(National Grid, 2020)

Summary

- The law was set by the UK government **to achieve net zero by 2050**
- The UK relies on **gas for 40%** of energy generation and **renewables for 37%** which is predicted to rise with the UK's new net zero laws
- Ofgem (the UK's energy system regulator) have acted accordingly with **a decarbonisation plan** to achieve this
- Leeds Council and Wakefield Council have also created decarbonisation plans, however Wakefield council have **little control** on the production of energy
- Due to the long term 2050 goal, using the grid may **not be a short term solution** to decarbonise our building, however we can be confident that long term there are plans moving towards net zero and this can be used **in the future**
- SYHA's gas and electricity network distributor and operators are National Grid, Northern Power Grid and Northern Gas Networks. The relevant commitments and ambitions have been stated in accordance to decarbonisation strategies.

WHINN DALE
SYHA

Figure 35: All Images

Image Reference
https://www.syha.co.uk/two-bedroom-apartments-or-bungalows-in-normanton/
https://housingcare.org/housing-care/facility-info-158135-whinn-dale-normanton-england
https://www.primelocation.com/for-sale/details/56695003

6.6 Site and The Surroundings

Summary

- Whinn dale is located in Normanton which is a town of Wakefield (South West of Leeds).
- The whole town is **surrounded by trees, farms and green space**, therefore the users can access them by **walking without transport** (which would increase carbon emission).
- The commercial building area is near **Normanton station (1.3KM)** and Normanton Industrial Estate, where public transport is needed for access.
- There are **2 local bus stops within 10min** state that the **existing public transport infrastructure is sufficient.**
- The project building site is in the residential area within a radius of 600m. There are also 4 more care facilities within a radius of 600m.
- Large green space is located in the northeast of the site, 500m away.
- The residential buildings near the site is around 9m height 2 stories building, with front and back yards.

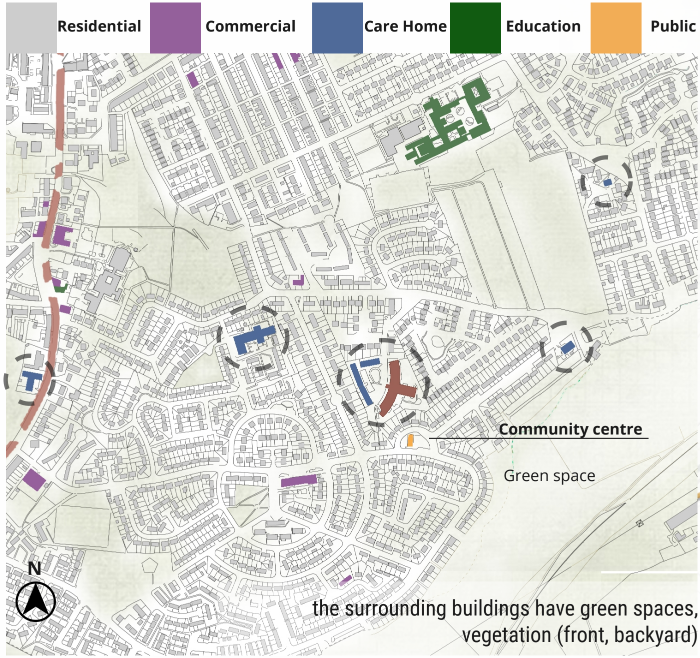
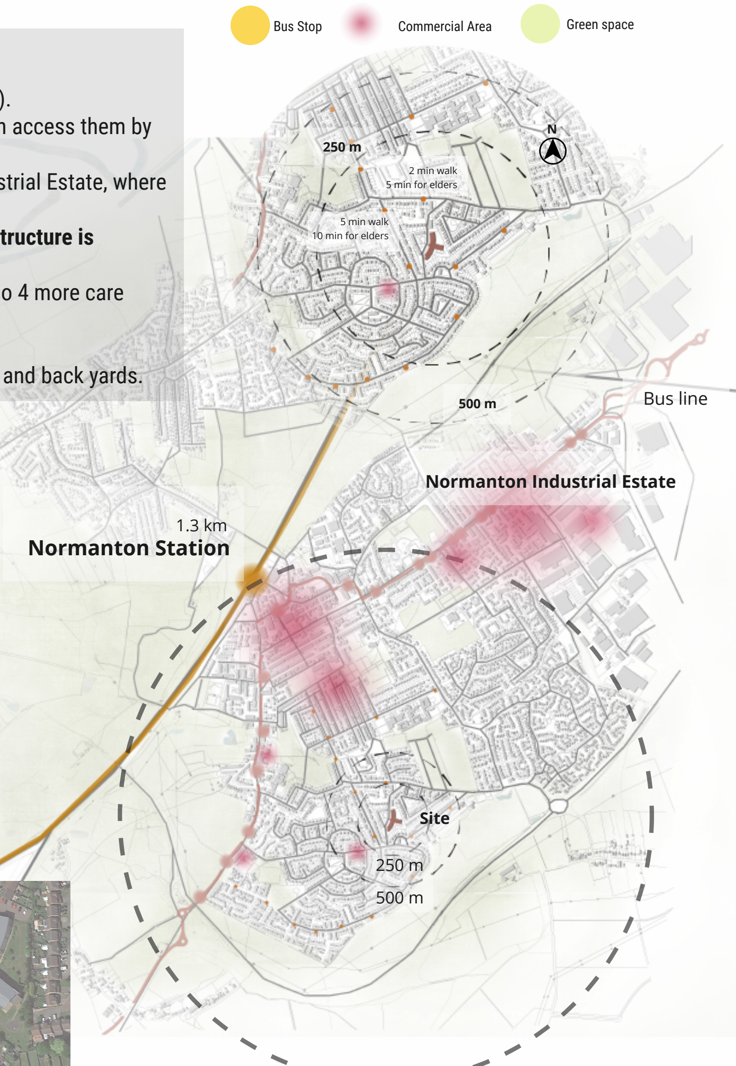


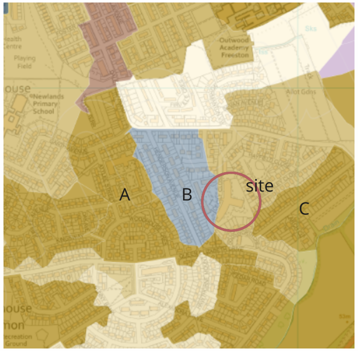
Figure 36: Google Earth Image



Site Analysis

6.7 Society Context

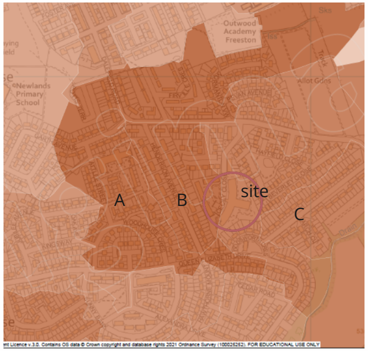
Area official classification



Ethnicity Central	
Multicultural Metropolitans	
Urbanites	
Suburbanites	
Constrained City Dwellers	
Hard-Pressed Living	

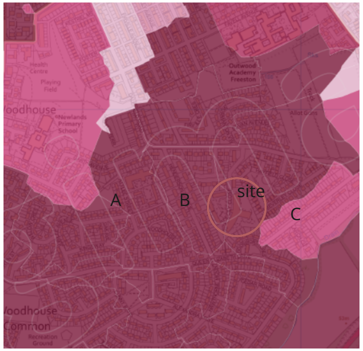
urban surroundings -high rates of divorce and separation - more non-dependent children - live in semi-detached or terraces - more social renting - less higher-level qualifications - higher rates of unemployment - work in mining, manufacturing, energy, wholsesale, retail and transport sectors

People activities limited by health condition



0.0% to 2.5%	
2.6% to 5.0%	
5.1% to 7.5%	
7.6% to 10.0%	
10.1% to 12.5%	
12.6% to 15.0%	
15.1% and above	

Socially rented



0%	
0.1% to 5.0%	
5.1% to 10.0%	
10.1% to 15.0%	
15.1% to 20.0%	
20.1% to 25.0%	
25.1% and above	

People live alone

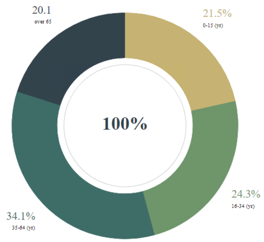
20% and below	
20.1% to 25.0%	
25.1% to 30.0%	
30.1% to 35.0%	
35.1% to 40.0%	
40.1% to 45.0%	
45.1% and above	

Figure 37: Digimap Society Roam

Population Aged

Average the Site, A, B, C area population age percentage:

- **People over 65 years old** are slightly more than **one-fifth** of the population in these areas.
- And the **35-64 group** and **over 65 years old group** make up **over half** of the population.



Summary

- The classification diagrams show that people there live a **hard-pressed life**, also approximately **20%** of the population in this area suffer from **health issues.** Therefore our design would have to consider **low-cost strategies** and **increase ease of accessibility and comfort.**
- High percentage of **socially rented** accommodation indicates that the community will change as individuals frequently move and leave the area. Therefore SYHA must create a **constant community environment for new residents.**
- **35% of the people live alone**, so strategies need to have more **community space** and some skill training or group activities to **overcome loneliness.**

6.8 Building Information - Site

Building Information

Name Whinn Dale - Homes for over 55s

Units 84 homes - 60 flats and 24 bungalows

Location Normanton, Wakefield, UK

Building Footprint 7279m2

Site approx 15230m2

Height 9.8m (three floors)

Completed January 2009

Architect South Yorkshire Housing Association

Owner/ Social Landlord South Yorkshire Housing Association

Key Benefits Round the clock care, one-to-one relationship with a key worker, Security and Privacy

On-site Amenities Restaurants, Laundry, Hairdressers, Computer suite, Recreational space, Communal lounges and Outdoor seating
On-site amenities indicate less travel which means less energy consumption. Therefore, our proposal would not focus on these as much.

Off-site Amenities Local fish and chip shop, Supermarket, Butcher, Post Office, Bus and Rail links.

Reference - 'Whinn DaleOlder people' by SYHA and Live Well

https://www.syha.co.uk/wp-content/uploads/A5-Whinn-Dale.pdf

Figure 38: Site Plan

1 Main Building - 60 two-bed flats
2 24 Bungalows
3 COMMUNAL GARDENS (identified as an area for improvement)

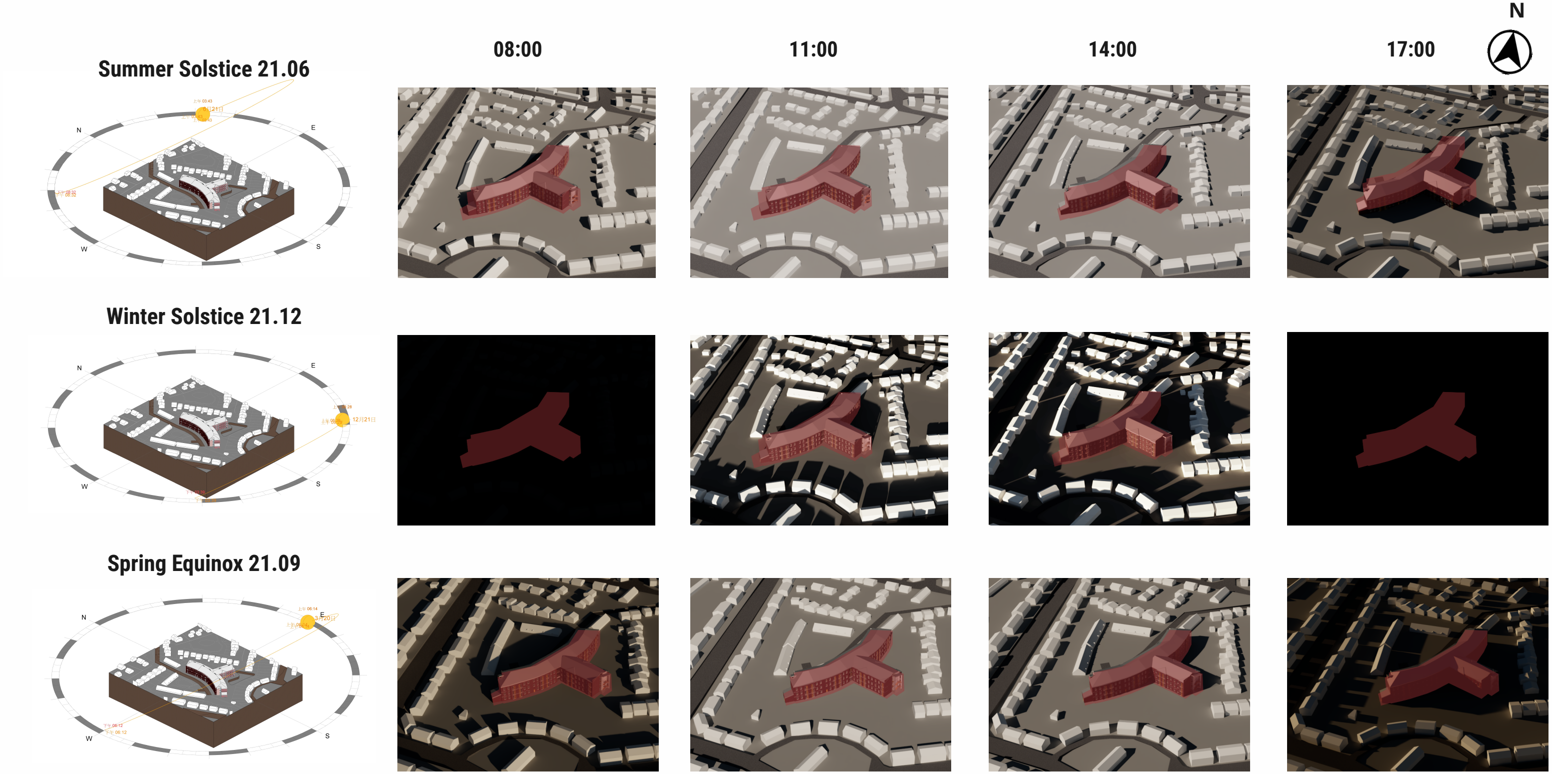
Research and Survey Reference - 'Holistic Interventions in Independent Living Schemes' by Laila Charlesworth, Healthwatch Wakefield.
Properties considered: Croftlands, Hatfield Court and Whinn Dale.

http://www.wakefieldjsna.co.uk/site/wp-content/uploads/2018/06/Care-Homes-Evaluation-Appendix-C-Healthwatch-Wakefield-Independent-Living-Report-2018.pdf

Summary

- The **indoor and outdoor layout** provides opportunities for social engagements and gatherings like day trips and meals, gardening, coffee mornings, quiz nights and bingo.
- Surveys and Research with focus groups suggested that **occupants desire larger spaces for gardening and outdoor laundry**.
- Occupants also expressed the need for **better connectivity** to nearby bus stops and post boxes.

6.9 Shadow Analysis

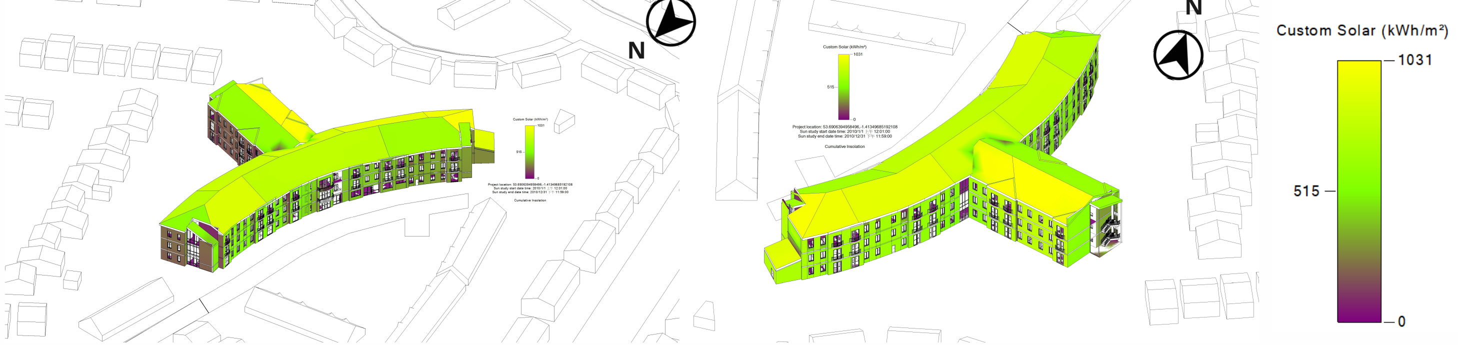


Summary

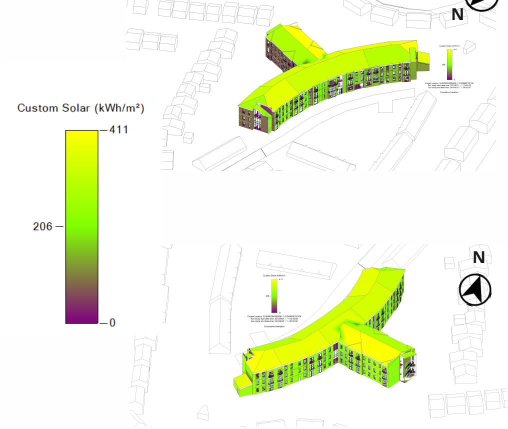
- During summer, the building mostly is **exposed to sunlight from 8 am to 2 pm**, however, the Eastern facade **is shaded at 5pm.**
- During winter, the building's South and East facades mostly are **exposed to sunlight from 11 am to 2 pm**, and Northern facades are shaded all the time.
- Our site **only overshadows** by the building itself because the surrounding buildings are not close to enough to the building. Also, the height is lower. Thus, the flat unit facing north would have **higher energy consumption** due to dependency on mechanical lighting.
- Flats on the **northern facade will have a higher energy consumption** through dependency on mechanical lighting. Therefore, if this cannot be reduced then renewable, on-site energy production should be increased.

6.10 Solar Radiation Analysis

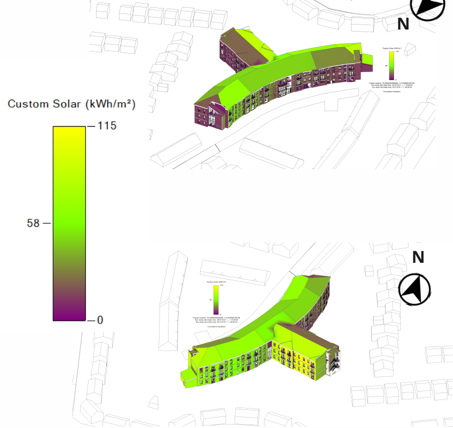
Annual
01.01-31.12



Summer
21.06 - 20.09



Winter
21.12 - 20.03



Summary

- The average level of solar radiation observed from the annual cumulative insolation is 515 kWh/m2 while the **maximum solar radiation is 1031 kWh/m2** which is generally received by the **South-West roof of the building**.
- The **summer** maximum solar radiation is 411 kWh/m2 (South-West roof of the building) which is the **highest** when compared to other seasons.
- The **winter** maximum solar radiation is 115 kWh/m2 (south-west facade) which is the **lowest** when compared to other seasons.
- The **South-West** side of the **roof** has the potential for **PV panels** to be placed due to the annually high accumulation on these surfaces. Also it would support the growth of **low-carbon technologies** as stated by **Northern Powergrid** in page 6.5

6.11 Topography and Water Management

WHINN DALE, CECILY CLOSE, NORMANTON, WF6 1PU

Lead local flood authority (LLFA): Wakefield council
The data implies that the highest risk of flooding is from surface water (especially from around the site). Each year, the chance of flooding is greater than 3.3%.
Whinn dale, in particular, is prone to surface water flooding/ flash flooding - happens when heavy rain does not drain away and can happen away from rivers and water bodies. It is more widespread in areas that have hardscape and climate change can increase its intensity. Wakefield Council's data anticipates a 20% increase in peak flows over the next 50 years.

Surface water

High risk

Rivers and the sea

Very low risk

High risk
3.3% risk each year
Very low risk
0.1% risk each year

Figure:https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=438848.84&northing=421716.88&map=SurfaceWater

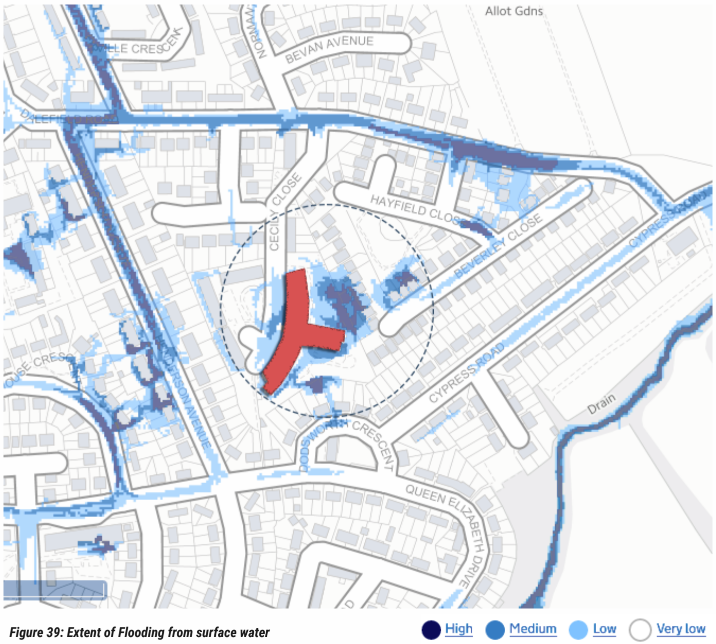


Figure 39: Extent of Flooding from surface water

WAKEFIELD DISTRICT

Wakefield district has experienced significant flooding in recent years (2007, 2012 and 2014) according to the Wakefield council report, 2016. Thousands of residents and commuters were adversely affected - local highway network, businesses, services, utilities, infrastructure, farmland and open land affected, with 4 primary highway routes recorded as impassable. In 2012 and 2014, residential properties were reported to have been severely affected.

Flooding has been caused by a combination of the following sources:

- High river and watercourse levels - High groundwater levels
- Excessive surface water runoff and Saturated ground - Overwhelmed sewers and highway drainage systems.

In regards to on going flood risk within the District, the latest national flood maps have identified over 6000 properties at risk of flooding from rivers and watercourses and over 2600 at risk from surface water flooding.

For the data collected - National flood maps, historic records and information shared with other Risk Management Authorities were used to understand district-wide flood risk and to effectively prioritise resource.

Figure and Text: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map
Text: https://www.wakefield.gov.uk/Documents/roads-parking/land-drainage-flooding/flood-risk-management-strategy.pdf

*Numbers of properties confirmed as flooded in June, 2007	
South Elmsall (town centre)	207
South Elmsall (Minsthorpe)	34
South Kirkby (area at Carr Lane)	35
Upton (south east)	27
Upton (south west)	57
Kinsley (area at Milton Drive)	31
Crofton (area at Ashdene Avenue)	24
Agbrigg (area at Agbrigg Road)	311
Agbrigg (permanent traveller site)	33
Wakefield (Westgate End area)	464
Wakefield (New Scarborough area)	61
Normanton (area at Newfield Avenue)	47
Purston Jaglin (area at Beech Grove)	20

Figure 40: Flooding Statistics

Summary

- Surface water flooding occurs when local drainage systems are **overwhelmed by excessive rainfall**, causing water to pond and flow above ground. Local drainage systems include **surface water sewers, combined sewers** (foul and surface water combined) and **highway drains.**
- Flooding has adversely affected - local highway network, businesses, services, utilities, infrastructure, farmland and open land affected, with 4 primary highway routes recorded as impassable. In recent years, several residential properties, especially in the east district have been **adversely affected by flooding.**

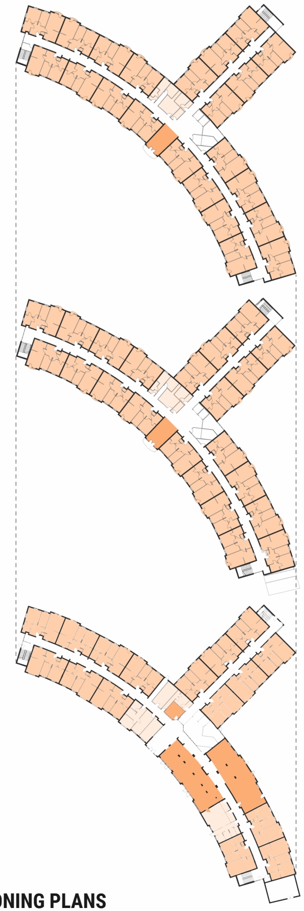
6.12 Building Information - Block

MAIN BUILDING

The Whinn Dale main building consists of 60 flats (2Bed) providing independent living with extra care run by South Yorkshire Housing Association. Whinn Dale provides supported housing for people over the age of 55 living in the Wakefield area. The properties have been specifically designed to meet the needs of older people who want to live independent lives whilst maintaining access to a range of support services.

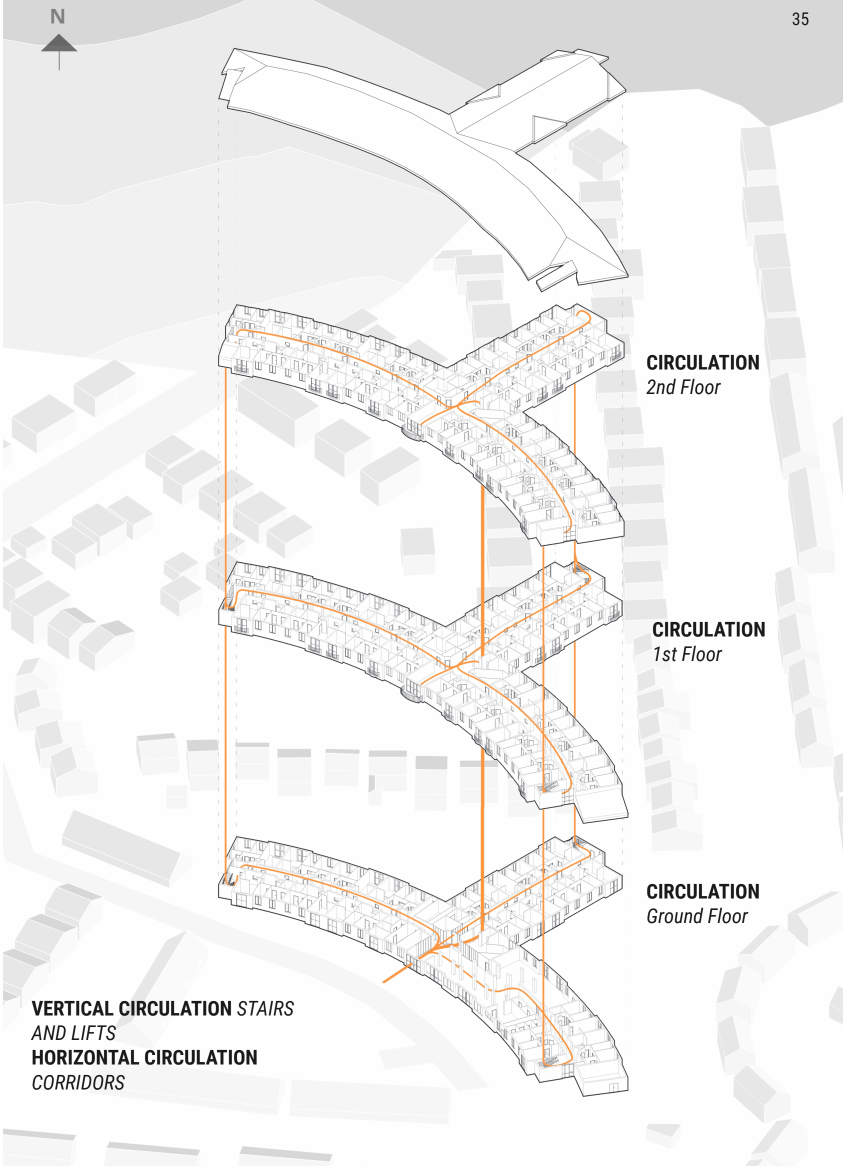
Summary

- Floorwise **User zoning was carried out** to understand the spatial distribution. At present, occupants open **communal windows** in the summer and their **main doors** to facilitate **cross-ventilation air** flows within the flats. The spatial distribution gives us clarity on the possible use/ conversion of spaces to address such issues whilst following the need for privacy.
- The circulation diagram indicates **horizontal and vertical flows**. Zoning plan analysis would also demonstrate that a one-way covid safe system could be implemented. Potential solutions to reduce **electricity/ energy consumption on account of the lifts** should also be looked into.



ZONING PLANS

- Staff Zone - *Offices + Service*
- Occupant Zone - *2Bed Flats*
- Mixed Zone - *Lounges, Restaurants etc.*



6.13 Illuminance Analysis - Clear sky

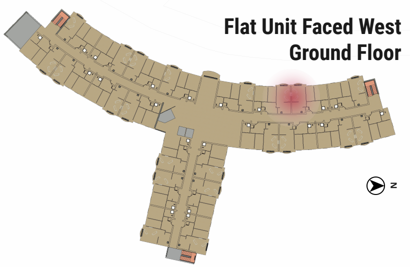
BREEAM- Hea01 Visual Comfort - daylight - up to ***three*** credits
flat unit spaces, Non-residential space average illuminance
100-3000 lux, 40%,60%, 80% of spaces - 1,2,3 credits respectively

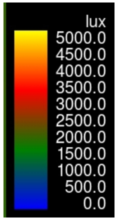
Building Performance Simulations

Lighting standard for Dementia-friendly Health and Social Care Environments

Health Building Note 08-02 Dementia-friendly Health and Social Care Environments states that the lighting should improve **throughout the building** to create a **minimum of 600 lux** for good visibility, visual access and safety.

GOV.UK. DH Health Building Notes. Retrieved May 31, 2021, from https://www.gov.uk/government/collections/health-building-notes-core-elements

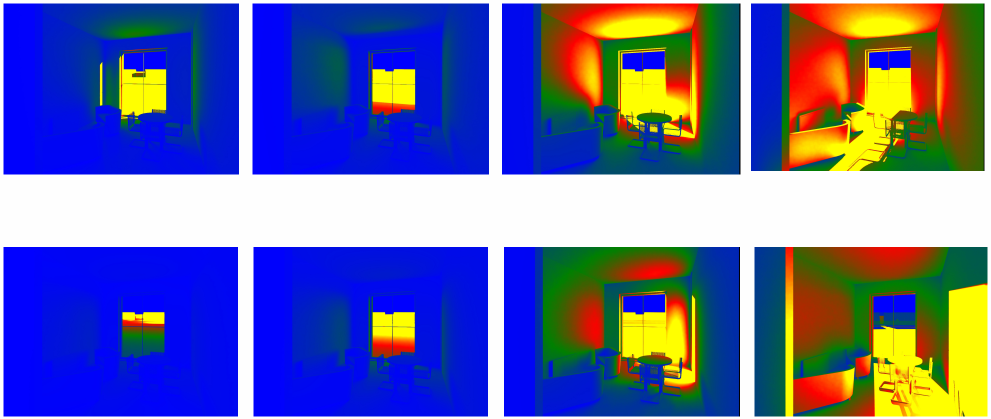




08:00 | 11:00 | 14:00 | 17:00

Summer Solstice 21.06

Winter Solstice 21.12

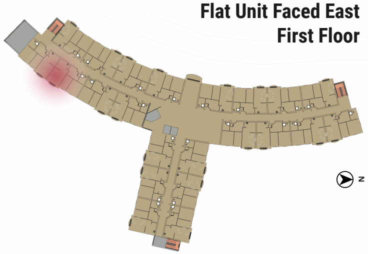


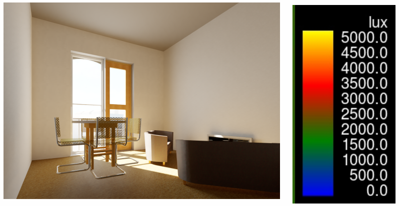
Summary

- All flat units only have **one aspect of the window** for ventilation and lighting.
- Therefore, the room only can access sunlight for a certain period of time(morning, midday, afternoon).
- Most of the time and space does not achieve the lighting standard of **600 Lux,** hence the indoor lighting will **consume much energy** on **mechanical lighting.**

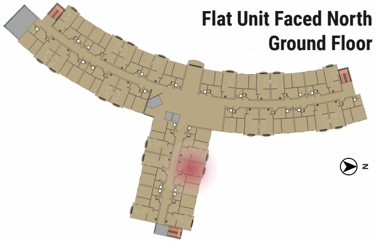
6.14 Illuminance Analysis - Clear sky

Flat Unit Faced East
First Floor





Flat Unit Faced North
Ground Floor



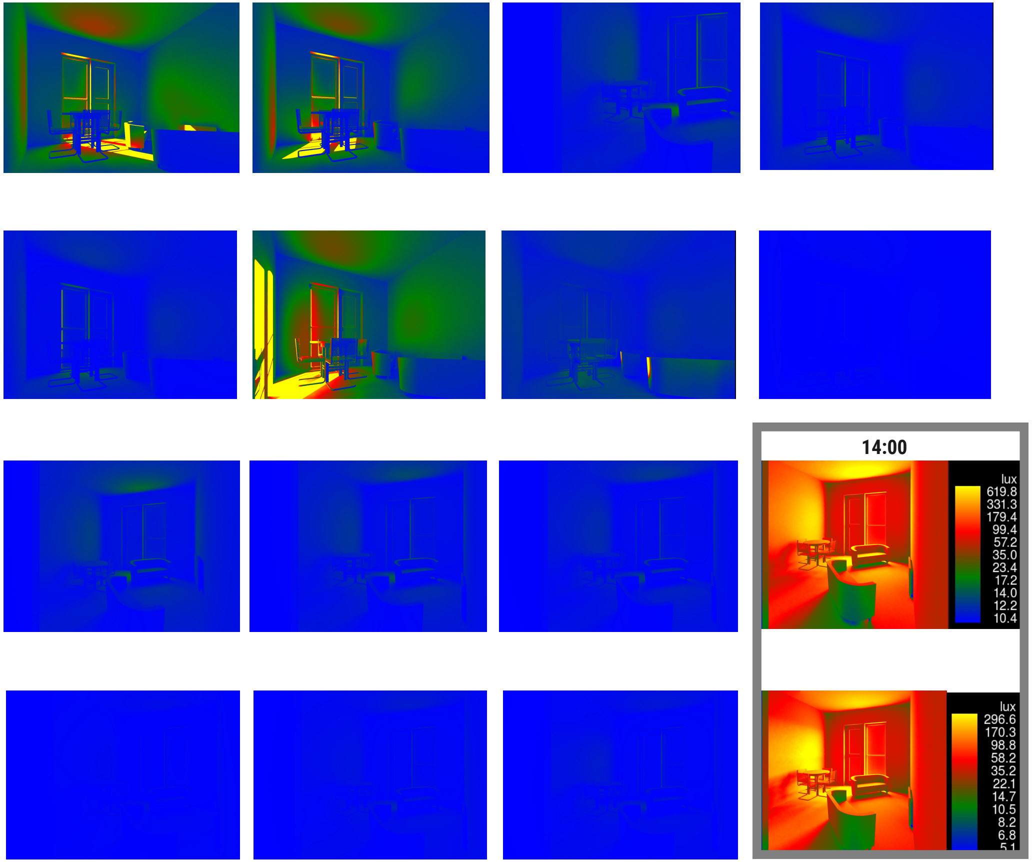
08:00 | 11:00 | 14:00 | 17:00

Summer Solstice 21.06

Winter Solstice 21.12

Summer Solstice 21.06

Winter Solstice 21.12



North facing flat units had a low quality of indoor illuminance, therefore the different range of lux are set to demonstrate their illuminance condition.

6.15 Daylight Factor and Illuminance

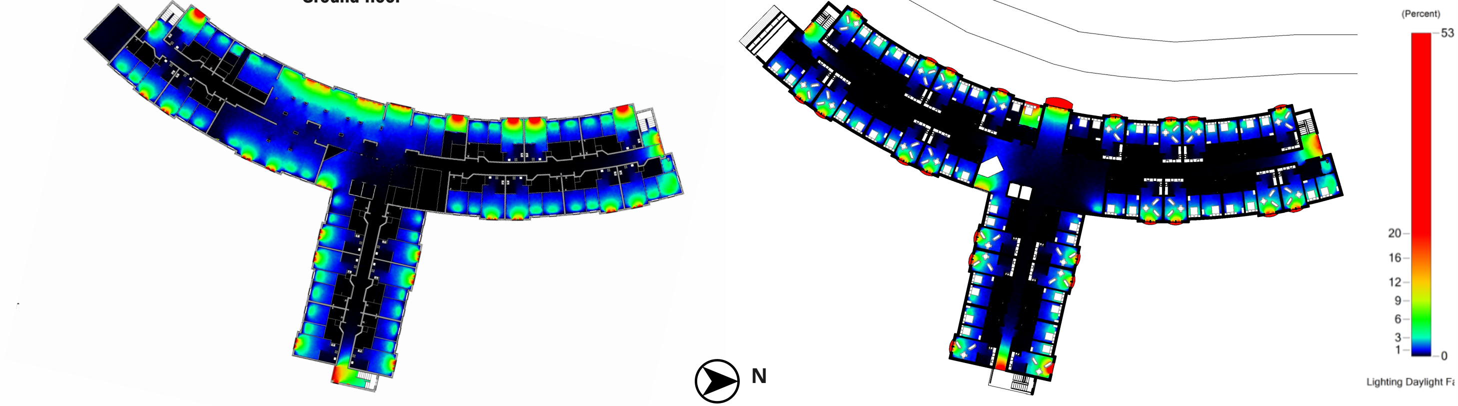
BREEAM- Hea01 Visual Comfort - daylight - up to ***three*** credits
flat unit spaces, Non-residential space average illuminance
100-3000 lux, 40%,60%, 80% of spaces - 1,2,3 credits respectively

Plan View

Building Performance Simulations

Daylight Factor

Ground floor **First floor**

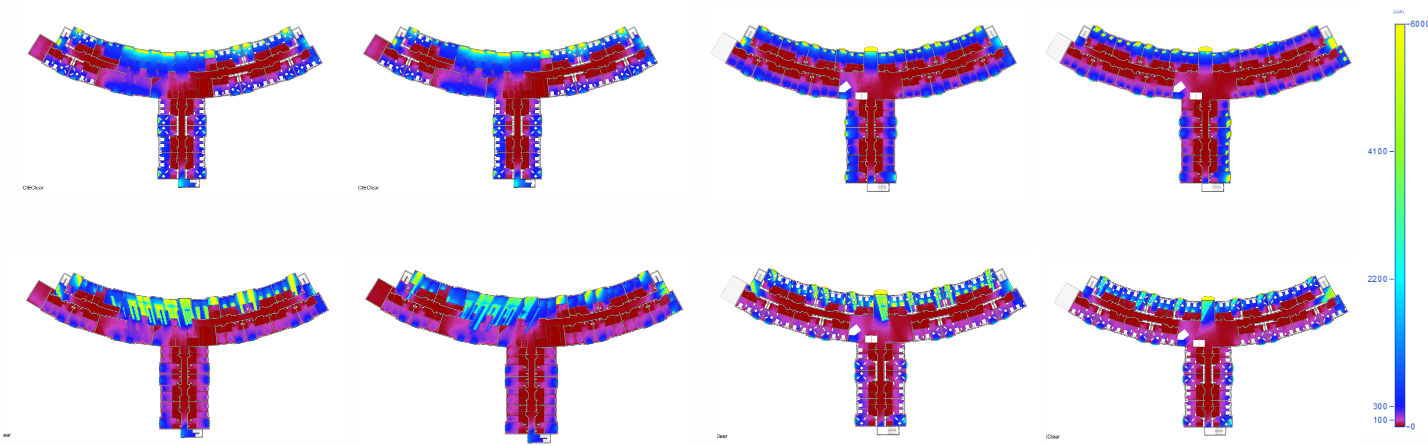


Illuminance (Clear Sky)

Summer Solstice

Winter Solstice

11:00 **14:00** **11:00** **14:00**



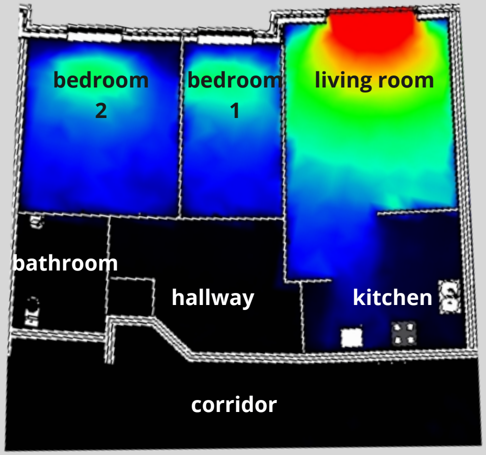
6.16 Daylight Factor and Illuminance - Plan

BREEAM- Hea01 Visual Comfort - daylight - up to ***three*** credits
flat unit spaces, Non-residential space average daylight factor 2%
40%,60%, 80% of spaces - 1,2,3 credits respectively

Building Performance Simulations

Daylight Factor

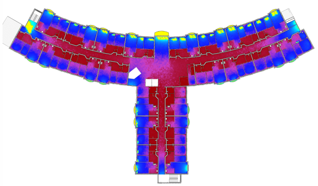
Second floor



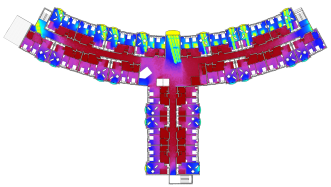
Illuminance (Clear Sky)

Summer Solstice

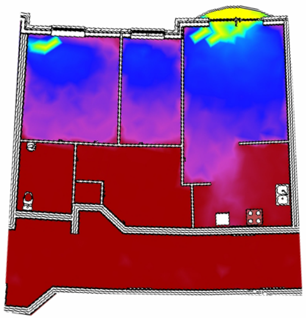
11:00

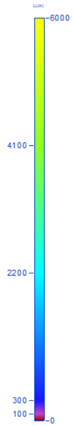


Winter Solstice



Summer Solstice
14:00





Summary

- Because of the unique shape of the building and the layout, the **corridor** is in a situation that daylight factor there is **nearly 0%.**
- Flat units are arranged by the building shape so the **living room and bedroom with a window** have an average of **2% daylight factor.**
- The flat unit has many walls to separate the room which affects the indoor natural lighting quality.
- The result demonstrates that the building **does not** receive **sufficient sunlight**, especially the **long corridor and sub-core space** need to **depend on mechanical lighting, which would increase the energy consumption.**

6.17 Energy Analysis

BREEAM- Ene01 Reduction of energy use and carbon emission
Whole building energy model - up to ***fifteen*** credits - expected improvement - over 66% (EPR NDR) - 11 credits

EXISTING ENERGY DEMAND (kWh/m2/yr)

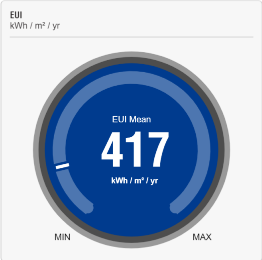
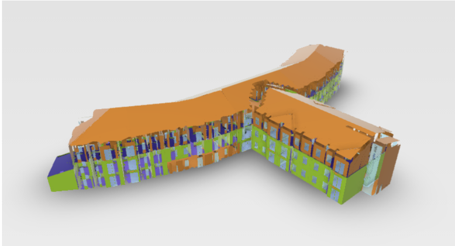
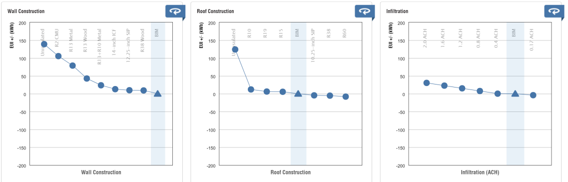


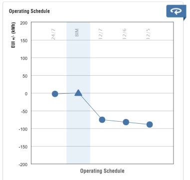
Figure 41: Energy consumption analysis



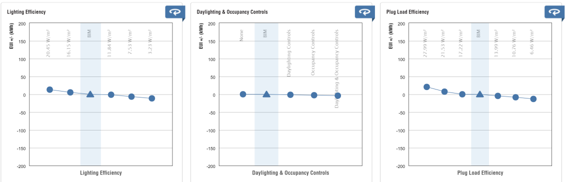
WALL AND ROOF CONSTRUCTION, INFILTRATION



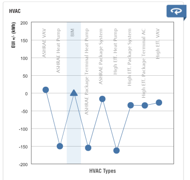
OPERATING SCHEDULE



EFFICIENCY AND CONTROLS



HVAC



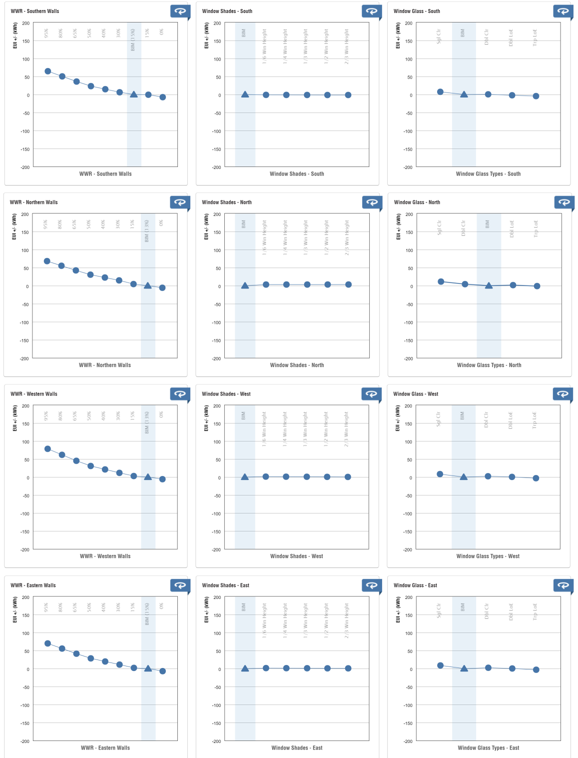
WINDOW WALL RATIO **WINDOW SHADES** **WINDOW GLASS**

SOUTH

NORTH

WEST

EAST



E

Summary

- The existing performance of the building uses **417kWh/m2/yr.**
- The improvements could mostly to be made to the **HVAC system and the controls**, focusing on improving this through the way that users interact with the building could make significant reductions in energy usage.
- It is noticeable that **any increase in glazing ratio** will result in a **higher energy demand**, this will need to be considered through our proposals.

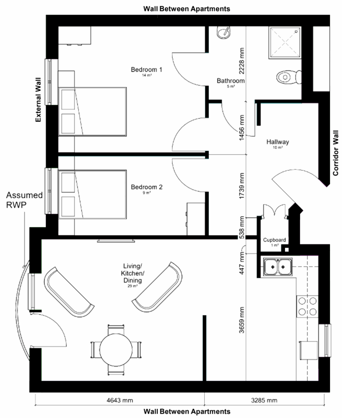
6.18 Unit Information

BREEAM- Hea01 Visual Comfort - view out - ***two*** credits
all position of bedsits and living room within 5m have windows.

BREEAM- Mat04 Insulation - embodied impact - ***one*** credit
external walls, ground floor, roof, building services achieve green guide rating A+.

Typical 2-Bed Flat Layout

The accommodation briefly comprises an entrance hall, kitchen/diner, living room, two bedrooms and a bathroom - all **spaces designed for wheelchair access**. The compact floor plan (720 square feet) has an **Energy Performance rating** of **C rating** which suggests that there is some room for improvement. From 1 April 2020, a minimum Energy Performance Rating of E is required and it applies to all tenancies – including existing buildings. Considering that Whinn Dale has a C (borderline B) rating, only minor modifications that could prove to be beneficial will be required.



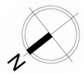


Figure 42: Unit Plan

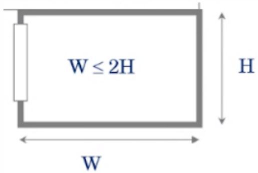
Ventilation

Whilst mechanical ventilation can improve the desired internal conditions of rooms, it is both expensive and energy consuming. Therefore, natural ventilation rule of thumb calculations should be conducted first to establish whether the ventilation strategy needs to be improved at all. These natural ventilation rule of thumb calculations are as follows:

Room	Width (mm)	Height (mm)	Ventilation Strategy	Effective? (Y/N)
Living/ Dining/ Kitchen	7928	2600 (assumed)	Single	N
Living/ Dining	4643	2600 (assumed)	Single	Y
Bedroom 1	4643	2600 (assumed)	Single	Y
Bedroom 2	4643	2600 (assumed)	Single	Y

(Natural ventilation calculations, Author's Own)

Figure 43: Single sided Natural ventilation principles (Robinson, 2020)



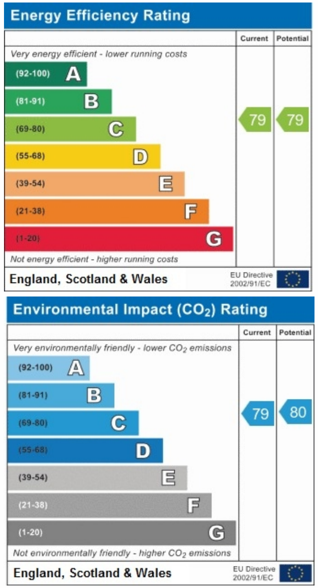


Figure 44: EPC rating

Text: https://www.primelocation.com/for-sale/details/56695003/ | https://www.landlordsguild.com/epc-minimum-energy-levels-explained/
Figure (Plans and Details): https://www.syha.co.uk/
Figure (EPC): https://www.primelocation.com/for-sale/details/56695003

FOR EXTERNAL WALLS
U-Value 0.1330 W/m2K
Required U-Value (AD-L1A) 0.3 W/m2K

FOR CORRIDOR WALLS
U-Value 0.1508 W/m2K
Required U-Value (AD-L1A) 0.2 W/m2K

FOR WALLS BETWEEN APARTMENTS
U-Value 0.1508 W/m2K
Required U-Value (AD-L1A) 0.2 W/m2K

FOR WALLS WITHIN APARTMENTS
U-Value 0.3510 W/m2K
Required U-Value (AD-L1A) N/A

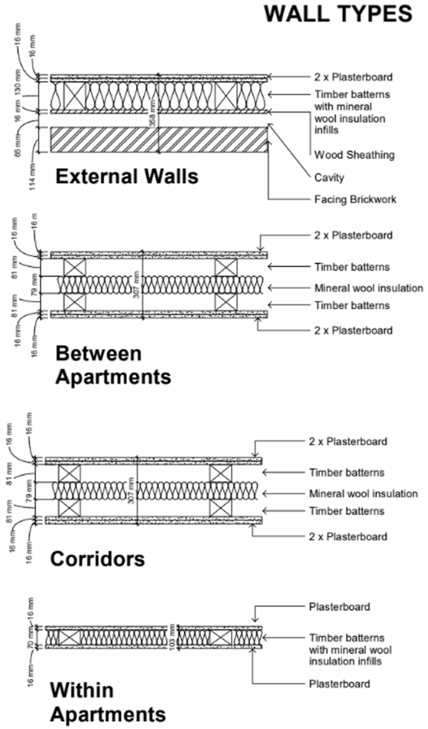


Figure 45: Wall details

Summary

- The flat was evaluated to have an EPC C rating although the wall details indicate **U-values** that are well **above Building Regulations standards** set in the **Approved Document L1A**.
- The flats pass both the required minimum EPC ratings for renting and buying, therefore the proposal will not look to dramatically improve the flats themselves, but rather the communal and outdoor spaces
- Both bedrooms and the Living/ Dining space recieve sufficient natural ventilation. However, due to the deep apartment footprint, the kitchen does not and therefore is likely to harm the health of the user, resulting in a higher dependency of high-emission health care services

6.19 Existing Internal Conditions

Desired Internal Conditions

The existing internal conditions of these apartments must be understood in order to provide a benchmark to improve upon.
Through the use of IES, a typical flat has been modelled and simulated to highlight the potential poor performance of the existing apartments.As identified in page 2.4, the internal relative humidity should be between 40-60% to limit the spread of COVID-19 and other possible diseases.

Assumptions

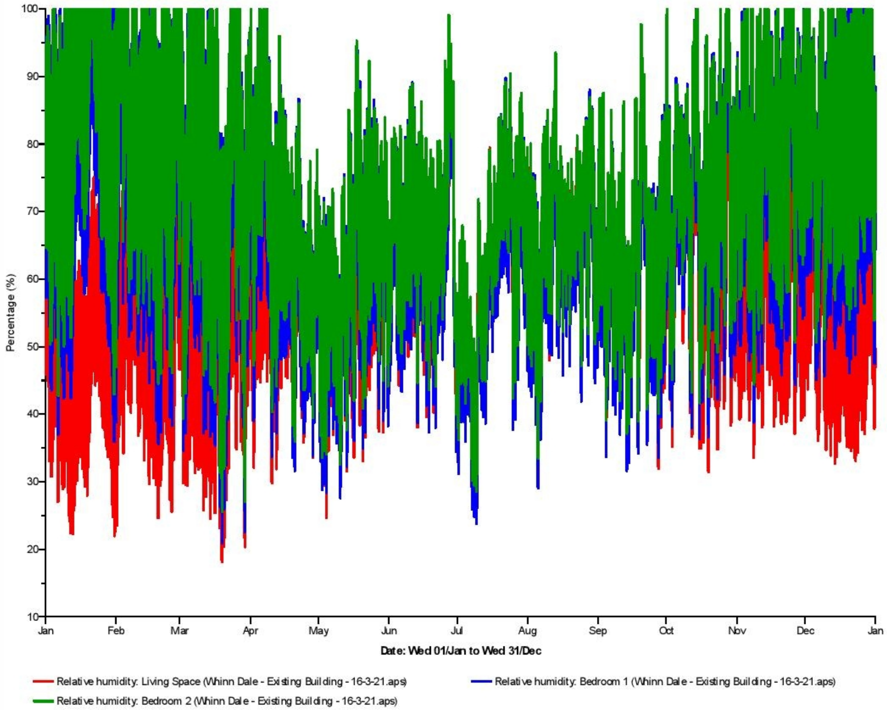
The following assumptions have been made about the existing apartments and the behaviour patterns of their users:

- Both bedrooms have the heating set at 22 degrees
- The living space has the heating set at 19 degrees
- The bathroom, storage cupboard and hallway are not of concern as they are not classed as habitable rooms
- Existing external wall U value = 0.1330
- Existing walls between apartment U value = 0.1508
- Existing floor U value = 0.1089
- Existing roof U value = 0.1089
- All habitable rooms have the heating constantly on during January, February, and November
- All habitable rooms have the heating constantly off during June, July and August
- Equipment, heating, lighting and occupancy within both bedrooms is on during the hours of 0400-1000 and 1600-2200 in the months of March, April, May, September and October
- Equipment, heating, lighting, occupancy and ventilation is on during the hours of 0600-1000 and 1800-2200 in the months of March, April, May, September and October
- Two people can occupy the living space at the same time
- One person can occupy each bedroom

Observations

Studying the output to the right hand side, the following observations have been made:

- The simulation is unlikely to be 100% accurate, although it does indicate areas to improve on
- Generally, Bedroom 2 has the highest relative humidity percentage and the living space has the lowest relative humidity percentage
- Throughout the apartments, the relative humidity percentage is high during the winter months
- July appears to be the most ideal month due to its small relative humidity percentage range
- Overall, the relative humidity percentage is too high to reduce the spread of COVID-19 (ideal range is 40-60% as stated in page 2.4)



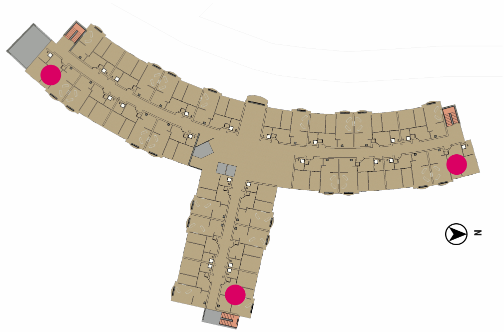
(Relative Humidity IES Typical Flat Simulation Output , Author's Own)

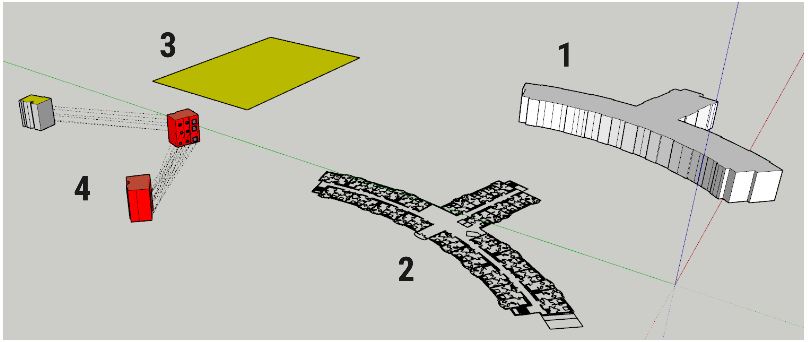
Summary

- The relative humidity percentage is **too high** to reduce the spread of COVID-19

6.20 DesignPH Analysis (Existing)

To understand the thermal performance of the existing building, a basic SketchUp model was created and simulated through DesignPH. Given that the free-trail of DesignPH was only available, select flats were simulated (see highlighted in red below). 3 flats were selected per floor, giving an overall total of 9 flats to be simulated in DesignPH:

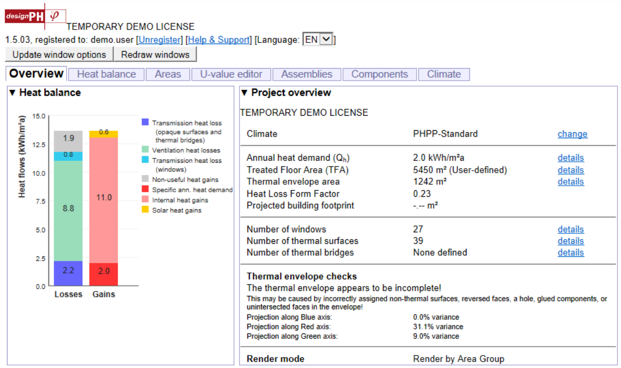




KEY
1 Overall building form (to be used should the full DesignPH version become available)
2 Floor plan provided to base the model off
3 Overall area of the 9 flats simulated (approximately 612m2)
4 Overall form of the 9 flats simulated (including their relationship to windows, etc)

Referring to page 6.18, the floors, walls and roofs modelled in DesignPH were assigned the presumed U values:

Assembly name	U-value (W/m²K)
PH External wall	0.133
PH Roof	0.1089
PH Floor	0.1089
PH Basement wall	0.25
Partition wall to neighbour	0.1508
Wall to zone X	0.15
PH External Door	0.5



In order to meet Passivhaus standards, the gains of the specific annual heat demand must not exceed **15 kWh/m2a**. The existing DesignPH suimulation output below highlighted that the building achieve approximately **2 kWh/m2a**:

Summary

- The DesignPH simulation and analysis conducted on the existing building suggests that **no major changes are required.**

6.21 Existing Floor Plan Analysis relative to COVID-19 and Sustainability

Existing issues

Through the simulation of the building and based on the WELL building standards identified in page 2.4, it is necessary to further assess the project building in the context of covid-19 pandemic.

Air

1. Is there effective natural ventilation?
Ventilation Effectiveness -WELL Feature A03

Assessment: There is sufficient natural ventilation in the living room and both bedrooms, but **not enough in the kitchen**. However it is assumed that the kitchen will have an existing mechnical extract fan.

2. Do the apartment windows open?
Operable Windows -WELL Feature A07

Assessment：At least 75% of regularly occupied spaces have operable windows that provide access to outdoor air. Thus the operable window **meets the WELL standard**

3. Where is the designated smoking area?
Ventilation Effectiveness -WELL Feature A02

The building meets WELL standards by **forbidding smoking indoors**. Outdoor smoking areas should not be located within **7.5m** of all building entrances, operable windows and building air intakes.

Light

1. Do the apartments have access to natural light?
Enhanced Daylight Access -WELL Feature L05

Assessment：The WELL standard requires that the window area be **no less than 10%** of the floor area . The building is currently just over 10%, and the existing light situation is not too bad. Improvements could be made to add more natural light to the **public spaces, particularly the corridors**.

Community

1.How can the sense of community be ensured when the COVID-19 pandemic is preventing human interaction?
Community Access and Engagement -WELL Feature C16

Assessment：Adequate community space is first required. The WELL standard requires that designated space be made available for public use free of charge, and that the total is at least 186 square metres (Existing is 383m2).
Also, during an epidemic, more than 4,000 square metres of outdoor garden space is available for a sufficient number of residents to interact with each other at a social distance.
Therefore, the design of the **outdoor garden** could be one of the priorities of the project. However, the current situation of the garden is the **lack of design**.

Mind

1.How is access to nature currently achieved?
Access to Nature -WELL Feature M02

Assessment：This WELL feature requires the integration of nature into the project's interior and exterior through design elements that support direct access with nature using plants, water, light and views, and indirect access to nature using natural materials, patterns, colors or images.

The most intuitive way to improve the mental health of the residents is through the **existing communal gardens**.

Figure 46: Well Standards

1.Overheating risks on the west facade

The west interior is at risk of overheating in the summer and the façade needs a buffer zone to reduce the impact.
Especially in summer, overheating can cause risks to users' health and put more pressure on public health services.

2.Lack of light in the corridor

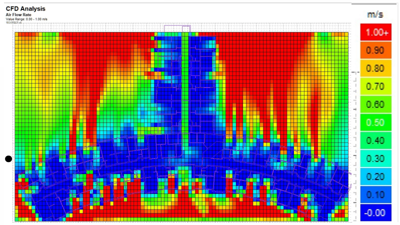
The corridor is too long and has no open areas for natural light, so a lot of artificial lighting is needed to ensure its use, which in turn leads to more energy consumption through a higher dependency on mechanical lighting.

3.Overly concentrated shared space

The shared space on each floor is too concentrated and the social life of the elderly will be greatly affected by the UK restrictions during the pandemic. And the over-concentration of shared spaces did not allow for safe social interaction.

4.Lack of cross ventilation in the corridor

The lack of open spaces makes cross ventilation in corridors ineffective. As recommended in A03 and A06 of the WELL standard, enhanced ventilation strategies can help dilute human and product generated air pollutants and reduce indoor CO2 levels.
As mentioned on page 7.9, occupants are used to opening the doors of their rooms for ventilation in summer. During the current pandemic, it was not possible for residents to cross-ventilate by opening communal/corridor doors and windows



The CFD ventilation simulation shows the wind speed and flow in the building. The already poorly ventilated corridor is slightly improved with the ventilation conditions with the doors open. But more importantly, this enhances the ventilation of the deeper interior spaces.

6

4

BUILDING LEVEL FRAMEWORK

5

IDENTIFY

Element	***Factors that contribute towards high energy consumption levels***
Potiental for renewable energy	Lack of on-site energy production
Potiental for renewable energy	Lack of on-site energy storage
Micro Climate Analysis	High relative humidity
Topograpghy and water management	Flooding
Building Information - Site	Lack of electric vehicle charging points
Gas and electricity operators	Lack of carbon capture
Illuminance analysis	Limited natural light access
Green infrastructure	Lack of enhanced gardening/landscape which directly contributes to the project i.e. source of food, limits the impacts of flooding
Floor plan research	Risk of overheating on the west elevation
Existing internal conditions	Lack of effective natural ventilation

SUSTAINABILITY **FRAMEWORK**

The recommendations identified above provide a basic checklist for SYHA to adopt in their current housing stock.

SUSTAINABILITY FRAMEWORK

This page will briefly outline the proposed measured to reduce SYHA's building energy consumption.

The recommendations identified in the table provide a basic checklist for SYHA to adopt in their current housing stock.

7

BUILDING LEVEL FRAMEWORK

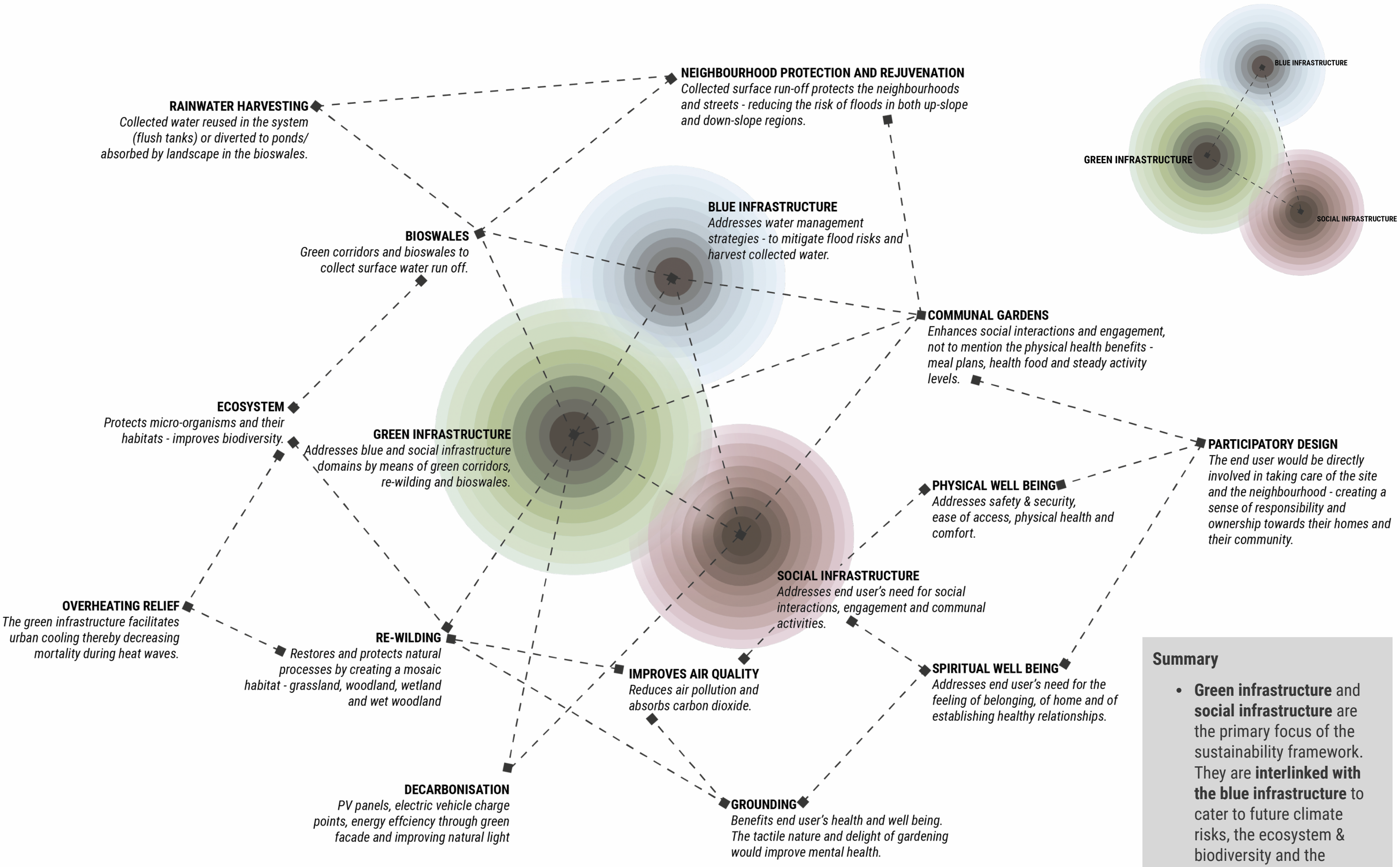
Factors contributing towards reducing high emission levels	Proposed means to reduce emissions
Lack of on-site energy production	On site energy production and collection through PV/PV-T installed on the roof as the building has good access to solar radiation
Lack of on-site energy storage	On site energy production and collection through PV/PV-T installed on the roof as the building has good access to solar radiation
Lowering the relative humidity %	Ensure airtightness within each flat so the relative humidity can be easily controlled according to an occupant's preference
Flooding	Garden/landscape plan which not only offers growth of health foods which can be used as part of the user's mean plan, but also limits the impacts of flooding. Finally, the selection of appropriate trees will ensure future carbon capture
Lack of electric vehicle charging points	Encourage sustainable travel by including electrical vehicle charging points
Lack of carbon capture	Garden/landscape plan which not only offers growth of health foods which can be used as part of the user's mean plan, but also limits the impacts of flooding. Finally, the selection of appropriate trees will ensure future carbon capture
Limited natural light access	Improve natural light access by installing roof lights to the top floor flats and communal corridors.
Lack of enhanced gardening/landscape which directly contributes to the project i.e. source of food, limits the impacts of flooding	Garden/landscape plan which not only offers growth of health foods which can be used as part of the user's mean plan, but also limits the impacts of flooding. Finally, the selection of appropriate trees will ensure future carbon capture
Risk of overheating on the west elevation	install green wall on west facade balconies
Lack of effective natural ventilation	Convert 1 lift into a stack ventilation shaft

6

PROPOSE

5

7.1 Sustainability Network



Summary

- **Green infrastructure** and **social infrastructure** are the primary focus of the sustainability framework. They are **interlinked with the blue infrastructure** to cater to future climate risks, the ecosystem & biodiversity and the occupants of Whinn Dale.

7.2 Green Infrastructure: Bioswales and Green walls

Greenwalls for Fabric Efficiency

Planting on walls performs as a highly efficient low-cost biophilia strategy. The species of plants can be chosen based on the orientation of the walls. For the Whinn Dale project (the west wall), honeysuckle climbers are recommended (Based on discussions with Ecology Students from the University of Sheffield). The curved profile can hinder light in some regions and therefore specific climbers like honeysuckle (Lonicera) have been chosen.

Potential Issues | Things to consider

- Consider plants that absorb less moisture. In the case of Whinn Dale, wall dampening issues have been reported, therefore a certain amount of moisture absorption will be beneficial.
- Roofs are highly susceptible to damage - the height of the climbers should be kept in check. Whinn dale is three storeys and would therefore be on the safer side.
- A thin mesh could be provided to control the spread and resolve any concerns of cracks on the brick walls

Figure 47: Green walls

Figure: https://in.pinterest.com/pin/313633561544432500/
Text: https://www.neverpaintagain.co.uk/blog/wall-damage-by-plants/

BREEAM- Pol03 Flood risk management and reducing surface water run-off- flood risk management - two credits surface water run-off - two credits	**COSTING - £935.52** **Green walls** (honeysuckle) - £7.60/m Green walls (labour) - £25/hr Total for west wall (90.2m for 10 hrs labour cost) - **£935.52**	**COSTING - £9762.00** **Bioswales** (honeysuckle) - £10-15/m2 including labour **Total** for Bioswales (£12.5/m2 for 780.96m2) - **£9762.00**

Bioswales for Water Management

Creates a green corridor, protects users from air pollution through multi-layered planting, achieves urban cooling through increased greenery, promotes health and wellbeing, and finally, creates habitats and protects the ecosystem.

Figure: https://patagonia.typepad.com/.a/6a00d8341d07fd53ef0192ac303e71970d-popup
https://depositphotos.com/vector-images/gardener.html
Text: https://www.nigeldunnett.com/grey-to-green-2/

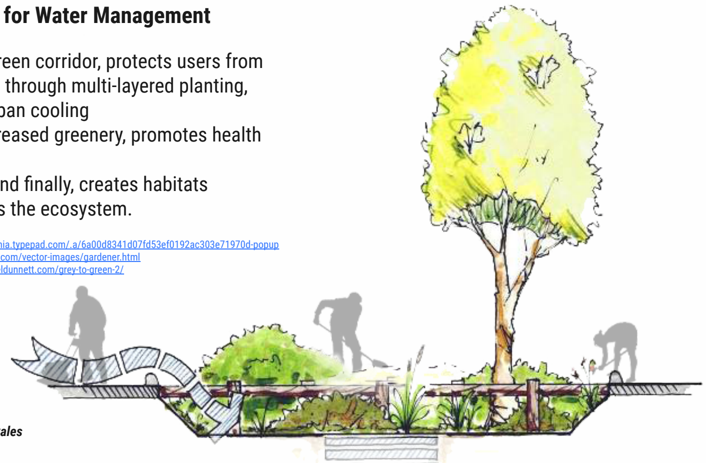


Figure 48: Bioswales

Bioswales form an effective strategy for high-flood risk management, especially in the case of mitigating surface water runoff.
This 'bio-infiltration' feature is a shallow depression, allowing water to flow into it.
It promotes infiltration back down into the soil beneath and evapotranspiration back into the atmosphere - urban cooling. As a result, most of the water is retained within the site, reducing the risk of flooding in the neighbourhood.
The captured water is absorbed by the plantings in the landscape or harvested and reused for flush tanks.
Planted with a diverse mix of open dry and wet perennial planting and mulch that absorb the runoff water - provides a landscape of communal gardening that would not only improve relations between the occupants but also between the occupants and the carers.

Collaboration: Charlotte Walker (Ecology, Undergraduate) and Emily Amas (Landscape Architecture, Masters) | The University of Sheffield

Summary

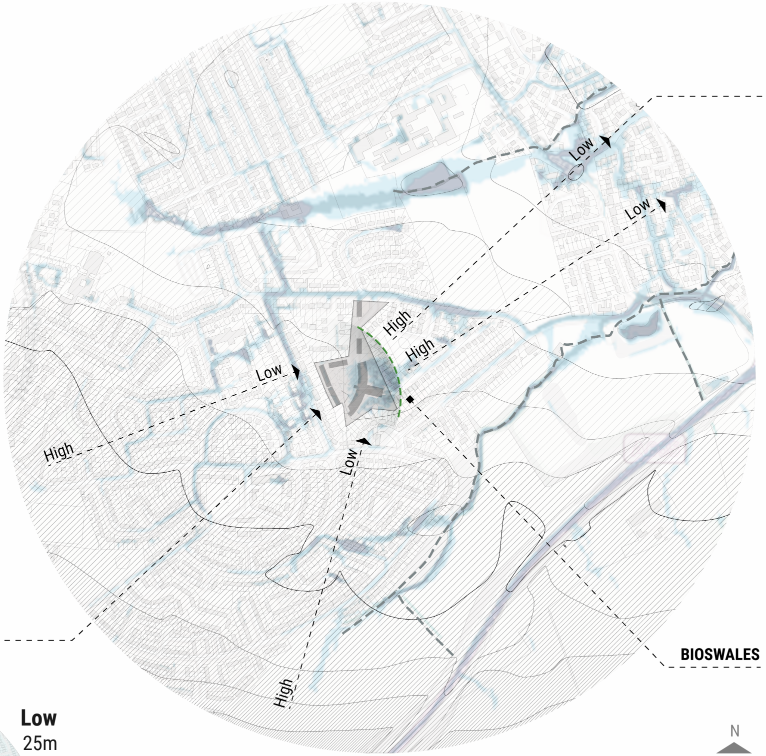
- Green walls and their benefits such as **urban cooling** could **reduce the risk of overheating** in the summers and provide an **additional layer of insulation** in the winters.
- **Semi-evergreen species** that partly shed in the winter would keep from hindering daylight reach indoors.
- **Bioswales** can help resolve larger issues of **water management, high-risk surface flooding** and **rainwater harvesting** whilst addressing the need for social engagement.

7.3 Green Infrastructure: Topography and Water Management

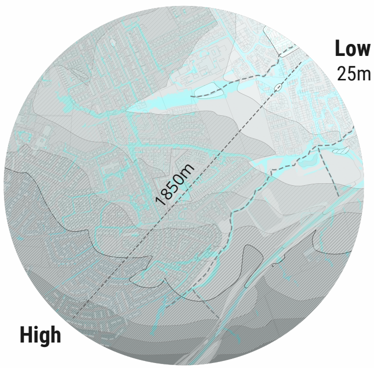
Site Specific Topography

The figure below indicates the gradation in the topography across the site and its context. The South-west corner is at about 75m and the north-east corner at 25m - a drop of 50m across 1850m or 1:35 gradual slope. Across the site specifically, there is 2.5m drop for 120m - 1:48 gradual slope.
The figure to the right utilises this data to analyse possible strategies for flood mitigation within and around the site.

The South-west coner is at the highest altitude in the indicated portion of the context. Therefore, surface runoff from here will be welcomed into the site and absorbed by the bioswales.



The North-east corner forms the lowest region in the indicated portion of the context and is therefore highly susceptible to surface runoff flooding. The drains in this region have also been known to be overwhelmed during flash floods. The bioswale proposal at the edge of the site prevents some amount of the higher region surface runoff from reaching this high-risk flood area.



Bioswales at the North-East Perfiphery of the Site

The strategically chosen location follows the contours to not only absorb runoff from the Southwest (higher topography) but also to prevent it from reaching the Northeast (lower topography) which is a high-risk flooding area. The bioswales essentially resolve much of the neighbourhood's flooding issues by welcoming surface runoff, absorbing it and preventing it from reaching further down.

Summary

- Although the site and it's context have a fairly gradual slope, they are still at **high risk of flooding** caused by surface water runoff - data from the Wakefield government (as mentioned in page 6.11). The data also suggested a **20% increase in flooding** over the next 50 years. Therefore, mitigation measures to prevent flooding within the site and its neighbourhood become **essential.**
- Considering that our end-users are over 55 and have health issues, the strategy incorporates **bioswales** that improve **health and wellbeing** whilst providing safety by means of its functionality.
- The strategy addresses **environmental concerns, social concerns** and **health and well being** - on the site level and the neighbourhood level.
- A thorough **understanding** of the master plan is now required in order to meticulously incorporate these strategies.

Solutions

7.4 Visuals - Bioswales

Summary

- The potential idea of Whinn Dale's green infrastructure merged with the social infrastructure

Figure: Authors Own

7.5 Rainwater Harvesting System

Benefits of Rainwater Harvesting

Harvesting and reusing rainwater can reduce the demand for water from the mains. This can minimises pressure on the conventional supply and cut bills.Rainwater harvesting also has a beneficial, if minor, effect on the drainage system as it holds run-off when it rains, rather than allowing it to go directly into the drains.

In most cases, the primary collection system is the roof. There are two reasons for this:

1. There will already be a setup in place (the guttering and downpipes) that can be used to convey rainwater to a storage tank.
2. Although roofs are not perfectly clean, there are fewer contaminants than are present at ground level. Foreign bodies such as leaves, can be easily removed.

Water is then pumped from the storage vessel, either directly to the points of use in the property or up into a secondary header tank in the loft for gravity-fed supply.

How much rainwater can be stored?

To work out the amount of water that could be collected from a domestic property, the first step is to identify the size of the catchment zone.
1.This is basically the area of the roof in plan (and therefore similar to the size of the ground floor of the house).
2.Next, find out the expected annual rainfall per m2 on the site. Log on to the **Met Office website** to check average values for all areas of the country.
3.The available rainwater would be calculated as follows:
Average rainfall (m) x area of roof (m2)
= available water (m3)
Only around **80%** of this will actually be collected, as some rainfall will be lost to evaporation and overflow.

Storage options

Rainwater tanks can be sited **above or below ground**, but the former will require protection from freezing. They're somewhat unsightly, too, so will need to be disguised.
A size of 1,500 to 2,000 litres (1.5m3 to 2m3) will supply most of the WC and washing machine requirements of an average household. In this project, there are 60 households in Whinn Dale with a total water storage requirement of approximately 1500L x 60 = **90,000 litres**. Generally, 5% of the available annual rainfall is a good starting point for the tank's storage capacity.

What does a rainwater harvesting system cost?

A commonly quoted figure for a fully-installed 1,500 litre system is £2,500. The pumps are surprisingly efficient, so running costs are negligible (expect to pay well under £10 year in most cases).

As there are economies of scale in terms of installation（For example a 20 m3 tank costs less than ten 1 m3 ones）, a communal system offers a greater cost saving, an efficiency gain and, theoretically, overall further reduction in the demand for treated water.

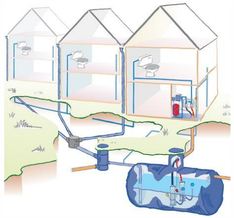


Figure 49: Rain water harvesting

If tanks were used for water storage, all households in WhinnDale would require approximately £2,500 x 60 = £150,000. Even if the tanks were to be integrated into a larger whole, the cost would still be staggering. Therefore, a more economical way of recycling rainwater needs to be found.

When will the investment return?

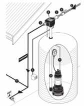
There is a rule, the more roof area available, the greater the potential mains water savings – and therefore the quicker the payback, even though the installation costs are higher. For new and existing dwellings of average size, the payback period ranges from 20 to 50 years.

Types of Roof Harvesting Systems(RHS)

Rainwater harvesting system can be divided to two types: **Roof harvesting system (RHS)** and Pond harvesting system (PHS).

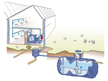
Also there are three main types of roof harvesting system: direct pumped, indirect pumped, and indirect gravity.

Direct-Pumped (Submersible)



Direct-Pumped (Suction)

Indirect Pumped



Indirect Gravity

Figure 50: Rain water harvesting Types

Summary

- Which system is used depends largely on the the **condition of the building**.
- **Pros:** Easy to **manage**; can serve **other buildings** in the community.
- **Cons:** Tanks may be **too large** or may need to be divided into **several separate** tanks. High cost.

7.6 Rainwater Harvesting System - Pond Harvesting System

(Zabidi et al., 2020)

Rainwater harvesting system

Rainwater harvesting system can be divided to two types: Roof harvesting system (RHS) and **Pond harvesting system (PHS).**

Pond harvesting system

The **storage** for PHS is a reservoir that is normally located close to the crop field with the purpose of enhancing and supplementing irrigations.

Components of PHS

- **Catchment surface:** The PHS harvesting the rainwater from the previous **land surface**. The catchment where the **runoff** can be **easily captured** such as a **public area, roads, or common land.**
- **Conveyance system**: The PHS using gravitational force to collect rainwater from catchment surface. Addressing Conveyance system to irrigation or pumb back to buildings.
- **Storage system:** the **soil** is used as the **basic structure** with designed large pond storage systems ranging from a hundred to a thousand m3. Storage for the PHS is an **open system** where the collected water is subject to losses due to seepage into the subsurface of soil and evaporation

PHS: Pond Storage

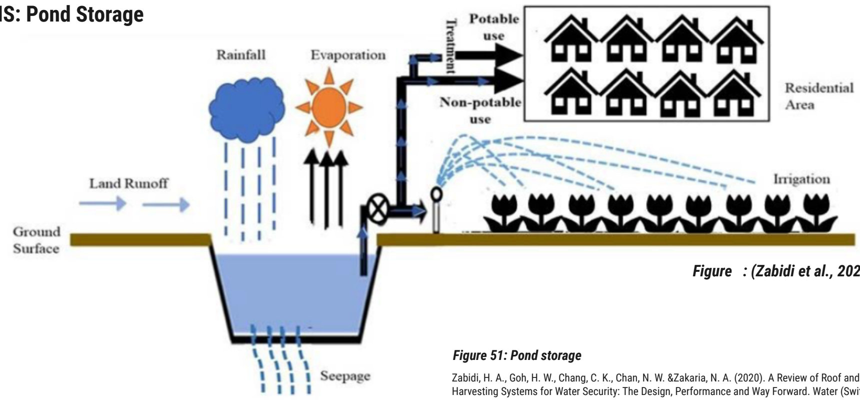


Figure : (Zabidi et al., 2020)

Figure 51: Pond storage

Zabidi, H. A., Goh, H. W., Chang, C. K., Chan, N. W. &Zakaria, N. A. (2020). A Review of Roof and Pond Rainwater Harvesting Systems for Water Security: The Design, Performance and Way Forward. Water (Switzerland), 12(11), 1–22.

Therefore, additional methods need to be implemented, for example, added a **lining**, **covered with corrugated items** and built with a **silt trap**.

- **The lining** (plastic sheets or concrete) with the purpose of minimizing the seepage losses of water captured into the soil subsurface.
- **Covered by a corrugated plate or plastic sheet** to decrease the evaporation losses.
- **Silt trap** which is located at the entrance of the storage system to avoid siltation and a spillway that controls the discharge of excess runoff.

Summary

- For the PHS, the selection of a site with **high to moderate runoff** was chosen as the most suitable area where it can harvest more rainwater and is able to **reduce the flood risk.**
- PHS can meet an average of 50% of the **irrigation demand** helping to reduce the risk of flooding
- PHS area is located in **higher elevation**, can use **under gravitational force with little or no pumping required**.
- PHS is located far from the distributed area, more energy is needed for pumping.
- PHS gives **high benefit returns and short payback periods**, especially the large pond size. However, this estimation is **only applicable for irrigated usage.**

7.7 Rainwater Harvesting System - Proposal

Rainfall calculation

Available water (from roof)= 0.835m/y x 3282m2 x 80% =2192m3/y
Direc gain (from pond)= 0.835m/y x800m2=668m3/y
Total=2860m3/y=715m3/season
Verification (Assuming a pond depth of 4m): 715/4=179m2(needed)
Conclusion: An area of 300 m2 and a depth of 4 m is appropriate for a pond

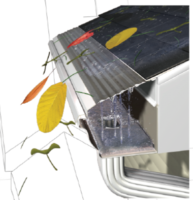


Figure 52: Gutters

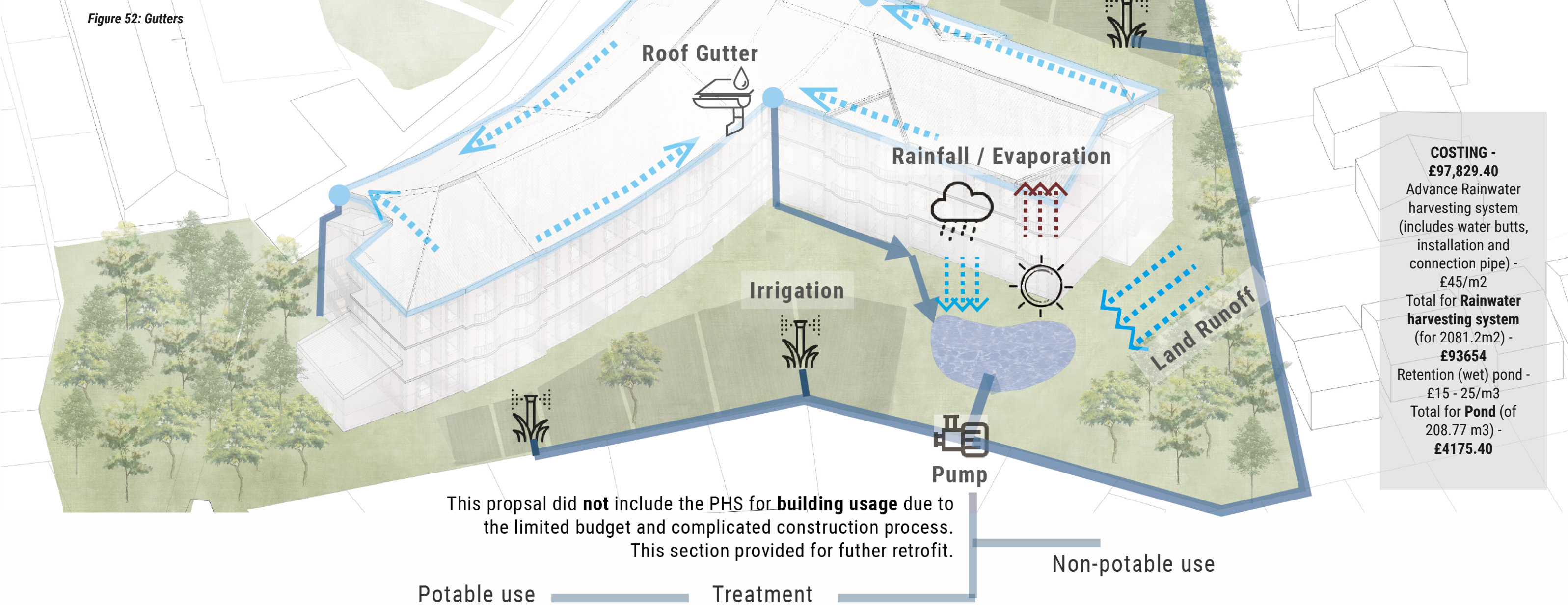
Rooftop water harvesting

The roof is divided into four zones and roof gutters are provided at the edge of the roof to collect rainwater to the four corners.

Rainwater Transfer

Rainwater is transferred from the downpipes at the four corners to the ground, where it collects through sloping pipes underground and eventually drains into the pond.

Figure 53: RWP



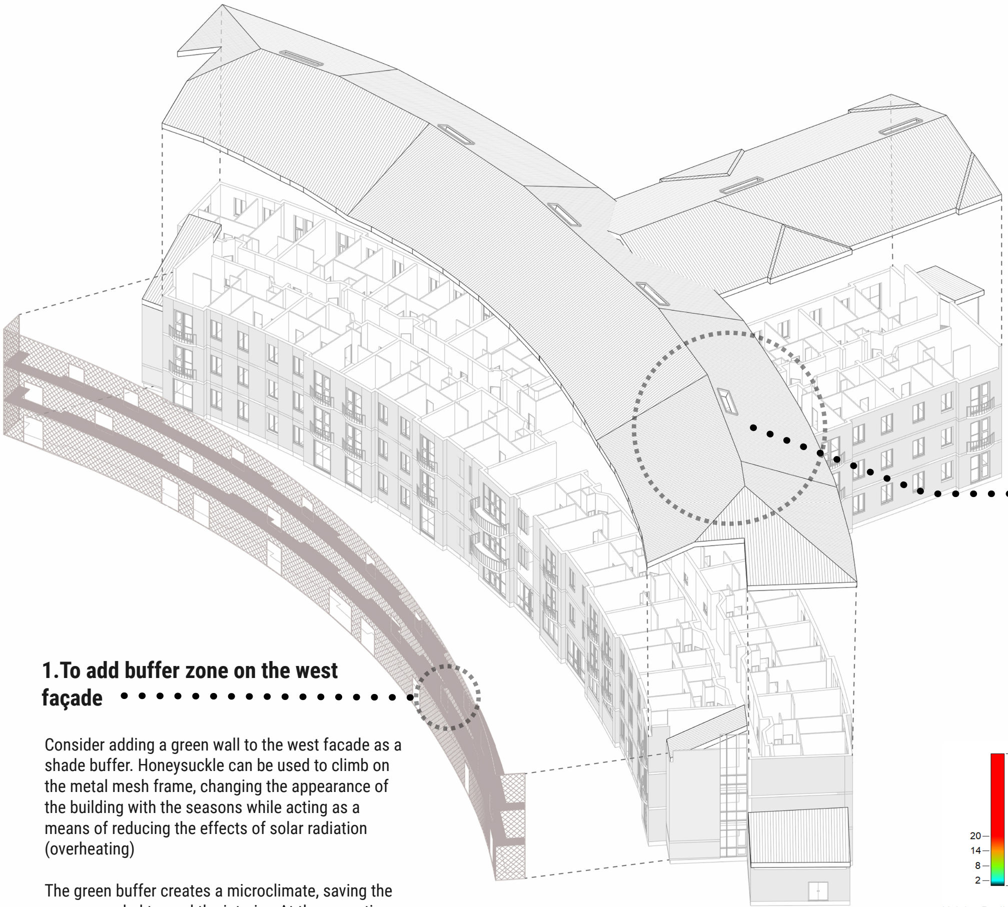
This propsal did **not** include the PHS for **building usage** due to the limited budget and complicated construction process. This section provided for futher retrofit.

COSTING - £97,829.40
Advance Rainwater harvesting system (includes water butts, installation and connection pipe) - £45/m2
Total for **Rainwater harvesting system** (for 2081.2m2) - **£93654**
Retention (wet) pond - £15 - 25/m3
Total for **Pond** (of 208.77 m3) - **£4175.40**

Solutions

7.8 Floor Plan: Proposal

Solutions



BREEAM- Hea01 Visual Comfort - daylight - Non-residential space average daylight factor 2% 40%,60%, 80% of spaces - 1,2,3 credits respectively	COSTING - £25,055.56
COSTING - £3,634.5 **Skylight** (HR++ glazing) - £110/m2 HR++ glazing for 24m2 - **£2,640** Skylight frame - £390/m2 Frame for 2.55m2 - **£994.5**	**Buffer zone** (primary timber frame) - £25.22/member Required 144 members - **£3,631.68** Buffer zone (square lattice) - £25.50/member Required 282 members - **£7191** Timber frame labour - £2-5/m2 Labour (for 530m2) - **£1855** Balcony Decking slab - £12 - 21/m2 Decking slab (for 339.12m2) - **£5,595.48** Balcony slab labour - £20/m2 Labour (for 339.12m2) - **£6,782.4**

3.To improving natural light

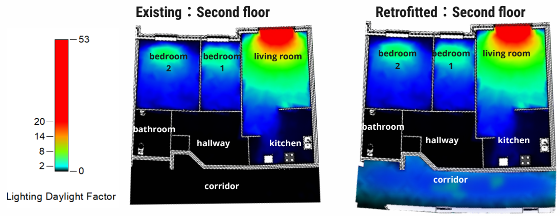
With regard to the low natural light in the corridors mentioned in section 6, it would be difficult to remove several flats for use as open space in order to ensure sufficient living space.

Consideration could therefore be given to add **skylights** on the top floor to bring in natural light.

1.To add buffer zone on the west façade

Consider adding a green wall to the west facade as a shade buffer. Honeysuckle can be used to climb on the metal mesh frame, changing the appearance of the building with the seasons while acting as a means of reducing the effects of solar radiation (overheating)

The green buffer creates a microclimate, saving the energy needed to cool the interior. At the same time the metal frame acts as a balcony for the residents.



7.9 Ventilation Strategy

VENTILATION SYSTEMS - MECHANICAL VS NATURAL

At present, Whinn dale has no strategy in place for ventilation. In order to safeguard against the pandemic and future pandemics, an effective ventilation strategy is required, especially considering our user group. For optimal ventilation and indoor air quality levels, the ventilation strategy would require the use of **mechanical ventilation with heat recovery**. However, installing such a system will result in **higher levels of energy consumption and carbon emissions** and might be **cost-intensive**. Another factor that prevents the use of the MVHR is the **low ceiling height** and its **inability to accommodate ducts**, not to mention the **disruption to the routine** and lives of the residents.

Therefore our **ventilation strategy** is to be structured to best cross-ventilation and **stack** airflows. As analysed in the **CFD wind simulation** (on the Floor Plan Research page), the **predominant wind direction** in the **winter** months is **west and south-west**. In the **summer** months, the wind direction is **west and north-west**. As a result of which, all year round, there is a **positive pressure** created on the **west facade** which implies that our **cross-ventilation** strategy should **consider a west-east airflow**.
In addition to this, the **residents** currently **use the circulation corridors** to **facilitate cross-ventilation** within their flats. Considering this on-site practice and our simulation results, the **proposed natural ventilation strategy utilises** both **horizontal and vertical circulation pathways**.

PROPOSAL

- **Wind Driven Airflow**/ Cross Ventilation - **Natural Ventilation with Heat Recovery and Cooling (NVHRC)**

Primary reservations with natural ventilation include - difficulty in precooling incoming air, controlling the draught and achieving optimum pressure differences to facilitate a high ventilation rate.

According to Christensen, 2014, these limitations can be overcome with the use of a tested concept based on natural ventilation with heat recovery and cooling (NVHRC) by a Danish ventilation systems manufacturer, IKM A/S.

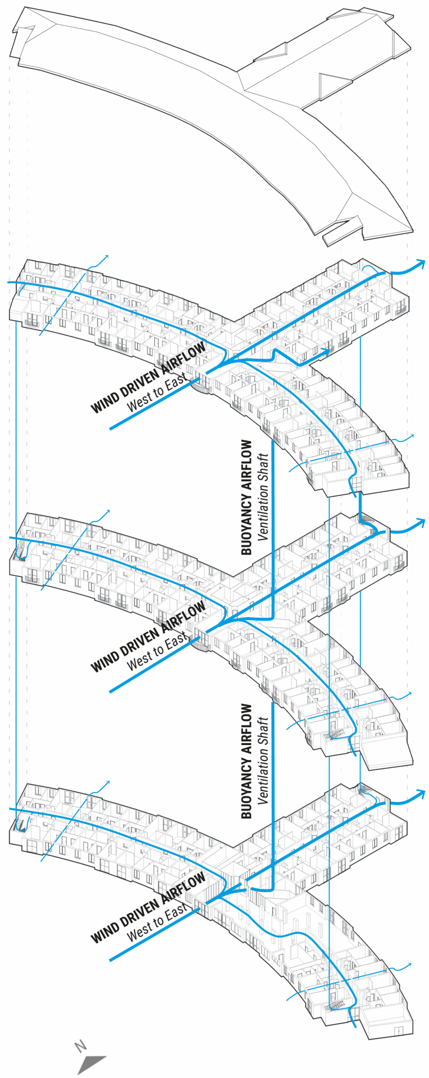
- **Buoyancy Airflow** - Lift Shaft converted to **Ventilation Shaft**

For optimal ventilation and indoor air quality levels, the ventilation strategy would require the use of **mechanical ventilation with heat recovery**.

BREEAM- Hea02 Indoor air quality - Indoor air quality (IAQ) plan - **one** credit Ventilation - **one** credit	**COSTING - £10702.00** **Decommissioning a lift** - **£10,000/lift** **Damper** - £234/piece For ventilation shaft with 3 dampers - **£702**	**COSTING - £13,950.00** **NVHRC** (Unit) - **£1500/unit** Labour cost for designing - **£550** Labour cost for installing - **£2000** Cost for commissioning - **£600** **3 units** required (one per floor)

Summary

- Limitations to ceiling height does **not allow for the use of an MVHR**
- However, some new technologies based on **natural ventilation** and **heat recovery** result in a **reduction of 40%** in energy consumption and therefore lower carbon emissions by 25-40% as well (Christensen, 2014).



Solutions

7.10 Ventilation Strategy

NATURAL VENTILATION WITH HEAT RECOVERY AND COOLING

The system works on the principle of recovering heat in the outlet air from natural ventilation and utilising it for room heating, preheating of the inlet air and heating of domestic tap water. In the summer, it is also possible to precool the incoming air and use the extracted heat from the cooling process to heat tap water. The system offers obvious advantages over mechanical systems - low energy consumption and therefore reduced carbon emissions, low installation costs and is especially beneficial for retrofit/ renovation projects as it doesn't need high ceilings to accommodate ducts (Christensen, 2014).

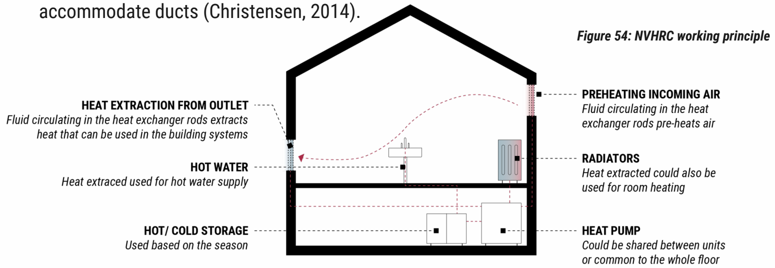
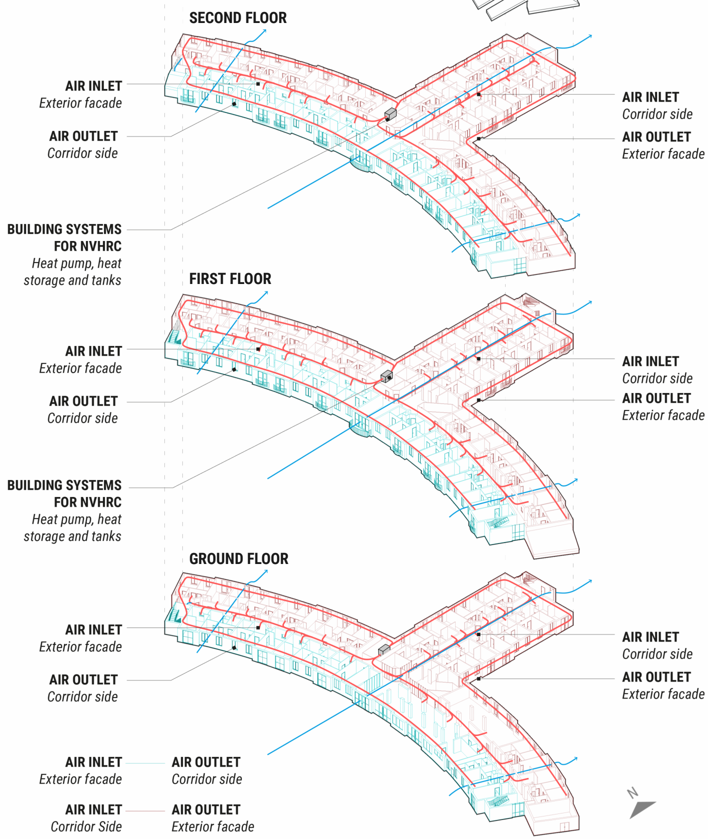


Figure 54: NVHRC working principle

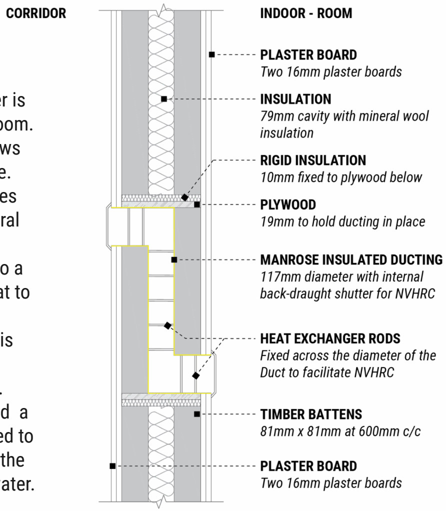
Summary

- Although the NVHRC is not as effective as a good MVHR, it does **address indoor air quality** concerns and helps **reduce the energy consumption** of the existing heating system.



WORKING ELEMENTS - localised installation of manroses required on existing walls - minimal intervention

- An air-to-liquid tube heat exchanger is placed in the air outlet in a given room.
- The special design of the tube allows for an optimum pressure difference. However, An axial ventilator provides back up exhaustion, when the natural driving pressure is insufficient.
- The circulating fluid is connected to a heat pump, which transfers the heat to the heating system in the building.
- From the heating system, the heat is distributed to hot tap water, room heating and preheating of the inlet.
- In the summer, If cooling is required a cold circulating fluid can be directed to an air intake unit. Heat gains from the outlet can still be directed to hot water.



7.11 Ventilation Shaft and Fire Safety

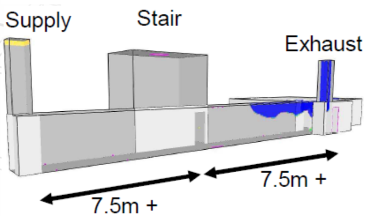
VENTILATION OF COMMON CORRIDORS

*Based on the **case study of a residential development, Tivoli House** containing 58 flats and the 'Ventilation using shafts' **research by Colt International***

For ventilation of common corridors in residential buildings, **a common shaft** passing through multiple levels allowing natural or mechanical ventilation via the **use of dampers or automatic opening devices on each level** can be employed. The system is **beneficial** to both **firefighters and building occupants**. Therefore, for **stack ventilation**, **our proposal** involves the **conversion** of **one** of the two **existing lift shafts into a ventilation shaft**.

Important criteria to meet building regulation standards:

- A **minimum shaft size of 3m2** with **dampers (minimum 1.5m2)** on each level. At **Whinn Dale**, the **existing shaft** size is **5m2**.
- Ventilation **dampers used on every floor** should be automatic via **smoke detectors** - to close off during a fire and facilitate stack exhaust through the shaft.
- For natural ventilation, **windows**/ openings at the **ends of the corridor** should be located on an external wall with a minimum free area of **1.5m2**.
- The vertical smoke/ ventilation shaft should be closed at the base.
- In the case of mechanical ventilation, supply and extract fans could be utilised on every floor.



Based on the **research 'Ventilation using shafts'** by **Colt**, the automatic vents allow **smoke** to be **controlled** depending on the location of the fire.

Figure 55: Ventilation shaft

Figure and Text Above retrieved from https://www.slideshare.net/Colt_UK/cpd-smoke-ventilation?from_action=save

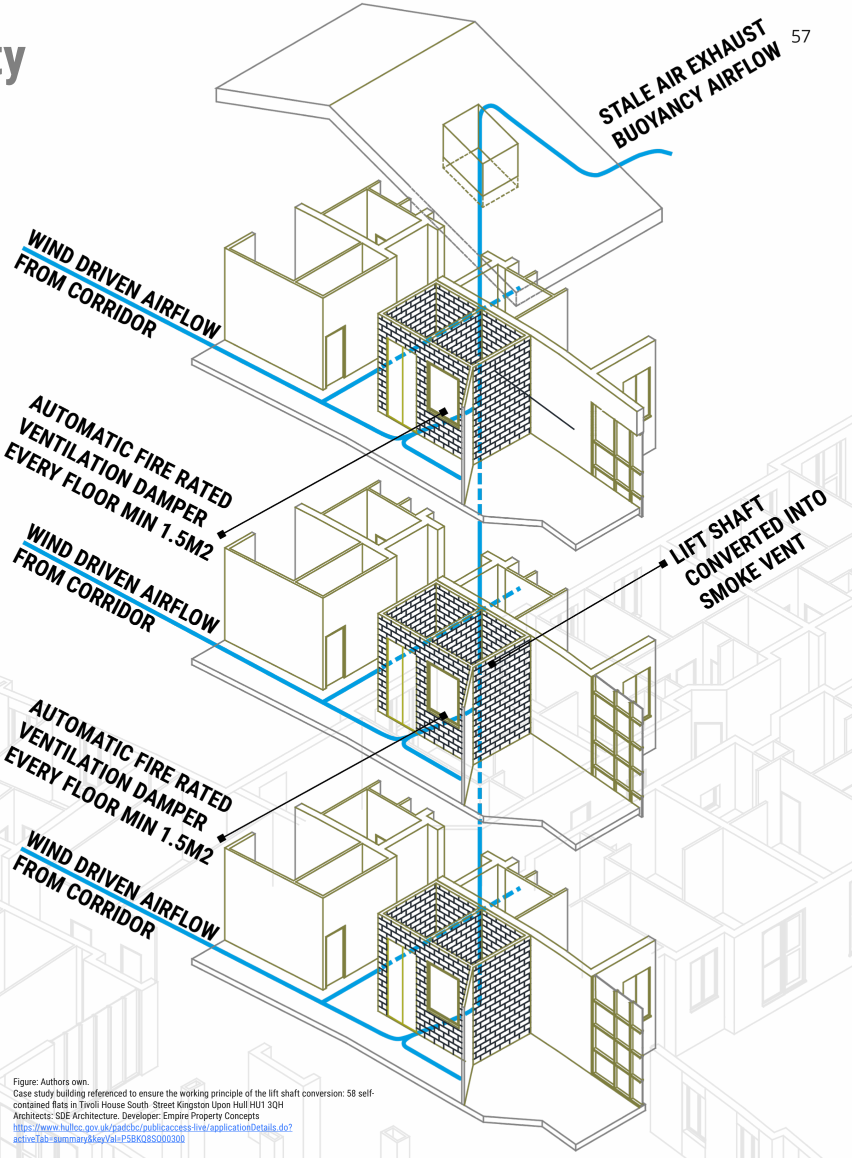


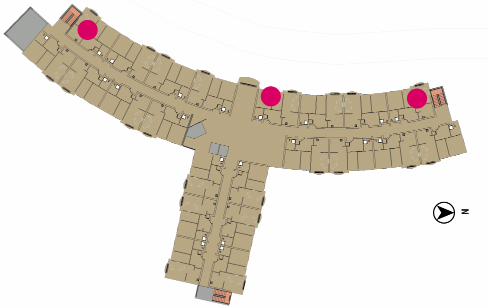
Figure: Authors own.
Case study building referenced to ensure the working principle of the lift shaft conversion: 58 self-contained flats in Tivoli House South Street Kingston Upon Hull HU1 3QH
Architects: SDE Architecture. Developer: Empire Property Concepts
https://www.hullcc.gov.uk/padcbc/publicaccess-live/applicationDetails.do?activeTab=summary&keyVal=P5BKQ8SO00300

Summary

- Research on life conversion, specifically the work of the BRE has resulted in **alternative methods of ventilation** being considered, which have now been incorporated into the new **Approved Document B.**

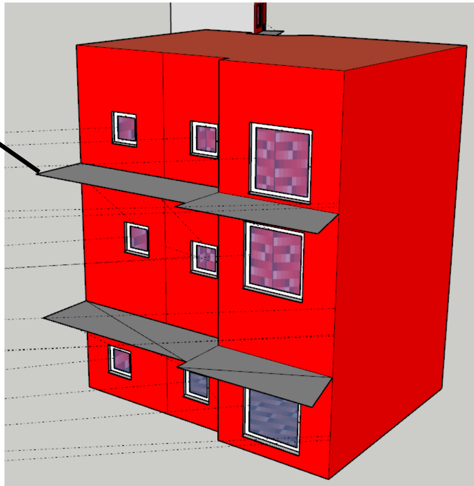
7.12 DesignPH Analysis (Proposed)

9 existing flats were simulated in the locations specified below (3 per floor) in DesignPH to understand how the building performs thermally:



The form of the flats has been updated to include the proposed perimeter balconies:

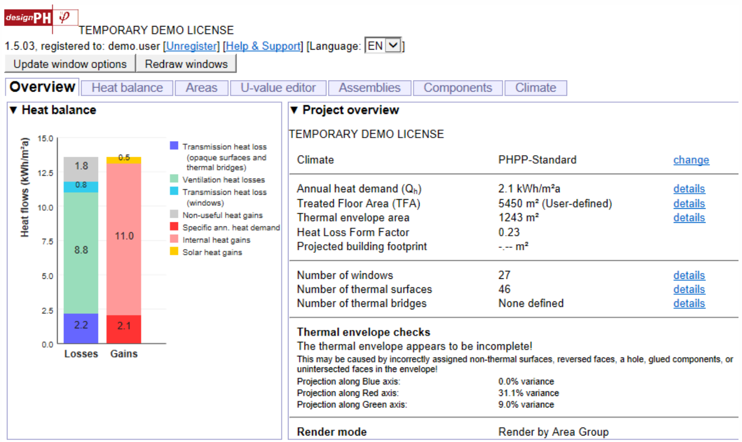
Green buffer zones on the west facade



Since all the existing build elements passing the U value requirements detailed in Table 2 in AD-L1A, their construction has not been changed:

Assembly name	U-value (W/m²K)
PH External wall	0.133
PH Roof	0.1089
PH Floor	0.1089
PH Basement wall	0.25
Partition wall to neighbour	0.1508
Wall to zone X	0.15
PH External Door	0.5

The existing DesignPH simulation output indicated the gains of the specific annual heat demand to be approximately **2 kWh/m2a**. The inclusion of the balconies seems to have slightly increased the demand (only to **2.1 kWh/m2a):**



Summary

- The DesignPH simulation and analysis conducted on the proposed building suggests that **the retrofit passes Passivhaus standards at a basic, conceptual level**

7.13 Proposed Site Plan

Solutions

Key	Proposal	Reason (User Level)	Reason (Building Level)
	Proposed bike store	To encourage exercise to reduce impact on public health services	To encourage the use of carbon neutral travel to reduce the impact on climate change
	Existing bin store	To educate customers on the importance of recycling etc.	To reduce the amount of waste going to landfill
	Existing plant room to house proposed solar energy storage equipment	-	To counter-balance the predicted increase in building energy use
	Areas subject to proposed landscaping/allotment/ rewilding	To encourage customers to change their diet by using localised foods. The areas identified will also offer customers a sense of responsibility through maintenance commitments	Improve air quality as well as encouraging biodiversity and reduce the impact of future flooding predictions
	Proposed primary electric vehicle charging points	To make the customers consider the impact of their travel choices	To reduce the impact of fossil fuel travel on climate change
	Proposed secondary electric vehicle charging points	To make the bungalow home owners consider the impact of their travel choices	To further reduce the impact of fossil fuel travel on climate change
	Proposed primary location of solar collection equipment (PV, PV-T)	-	To counter-balance the predicted increase in building energy use
	Proposed secondary location of solar collection equipment (PV, PV-T)	-	To counter-balance the predicted increase in building energy use

BREEAM- Tra03 Cyclist facilities - cycle storage and cyclist facilities - **one** credit (care homes) **BREEAM- Tra04 Maximum car parking capacity** - two credits 120 users(85inhabitants+35 staffs)/24(parking space)=5	**COSTING - £8,862.00** **Bike store - £894/rack** (5 numbers required) **Electric vehicle charging points - £549/piece** (8 required)	**COSTING - £658,184.30** **Solar panels** - £315/m2 (2081.22m2 required) Labour for solar panels - 200/day (13 days required)

7.14 Proposed Cross Section

EAST

WEST

Roof lights to be fitted to increase natural light and ventilation within the top floor communal spaces

Min. 500mm clearance from surrounding roof structure to comply with AD-B

Mineral wool insulation to be installed above existing tiled ceiling. Mineral wool specification TBC but must ensure overall U value achieved meets or betters that for 'Roof' within Table 2 of AD-L1A. All existing ceiling tiles to be retained during installation process and reinstated

Assumed existing tiled-ceiling to house natural ventilation with heat recovery and cooling (NVHRC) by a Danish ventilation systems manufacturer, IKM A/S. All existing ceiling tiles to be retained during installation process and reinstated. All pipework to be insulated and fire stopped.

All existing roof spaces to be treated as unheated

Existing lift shaft walls to be sound testing. Should the results fall below those set in AD-E, then Gyplyner independent wall lining system to be installed on the flat-side face of the existing lift shaft walls

Roof to be fitted with PV/PV-T panels (solar energy storage equipment to be located in existing plant room). Solar energy to be used to charge electric vehicles

Compartment walls taken up to underside of existing roof to achieve 60 min fire protection between flats

Insulation not to be taken past the top floor ceiling as roof void is treated as 'unheated' space. Wall construction still expect to achieve 60-minute fire rating

60-minute fire rated wall construction to provide natural light access from proposed roof light into top floor corridor

Internal RWP to be installed to avoid RW build up

All internal flat walls only taken to underside of ceiling (unless within a protected corridor) to comply with AD-B

All existing rain water goods to be assessed and repaired locally where required

Existing internal windows between flat and communal corridor to be occupant operated as a means of providing cross ventilation

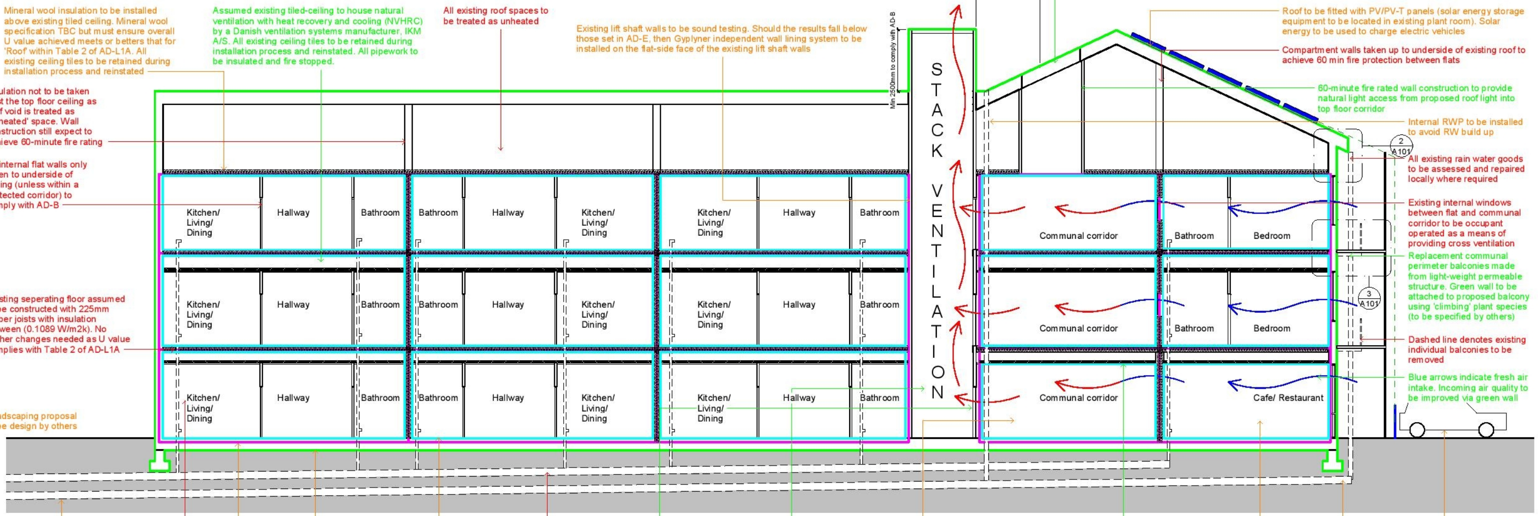
Replacement communal perimeter balconies made from light-weight permeable structure. Green wall to be attached to proposed balcony using 'climbing' plant species (to be specified by others)

Existing seperating floor assumed to be constructed with 225mm timber joists with insulation between (0.1089 W/m2k). No further changes needed as U value complies with Table 2 of AD-L1A

Dashed line denotes existing individual balconies to be removed

Blue arrows indicate fresh air intake. Incoming air quality to be improved via green wall

Landscaping proposal to be design by others



Proposed drainage network (to feed into proposed bioswale for recycled grey water)

All flats must have access to broadband, TV and WIFI as per AD-R (Electronic communications)

Green lines denotes weather-proof envelope of building

Purple lines denotes thermal envelope per flat **not** overall building

Blue lines denotes air tightness boundaries. Air tightness layer will ensure that the internal conditions can be better controlled therefore RH can be controlled to be within the 40-60% as stated in the WELL Standard

Assuming existing foul drainage network. CCTV drainage survey to be conducted and repairs conducted where required

Doors into stack ventilation to be fitted with automatic actuators. Actuators to open doors either in the event of a fire or when overheating occurs within the communal corridors

1 of the 2 existing lifts to be discontinued and shaft to be used as a means of stack ventilation

Communal corridor to be treated as 'heated'. All existing radiators to be retained

Mineral wool insulation to be installed above existing tiled ceiling **during a further retrofit depending on further improvements to the UK's building regulations**. Mineral wool specification TBC but must ensure overall U value achieved meets or betters that for 'Roof within Table 2 of AD-L1A. All existing ceiling tiles to be retained during installation process and reinstated

All existing car parking spaces to be fitted with electric vehicle charging points

RWP to connect to underground drainage network to drain into proposed pond. Pond to provide grey water for flushing toilets etc

Cafe/ Restaurant to be used to encourage communal dining for occupants. Refer to meal plan pages to understand how on-site food production assists to low energy consumption

PROPOSED CROSS SECTION
(1:75 @ A1)

Existing MDF 25mm window board internally and uPVC window cill externally. All to be inspected and made good where required

All existing external wall insulation to be inspected prior to occupation. Should any EPS insulation be defected, it must be replaced with mineral wool insulation. Data sheets and test certificates must be provided to ensure a fire rating of A1 is achieved.

Assumed locations of existing vertical cavity barriers. All locations to be checked on site and new cavity barriers to be installed if missing

All existing external walls to be stripped off finish back to plasterboard. Wet plaster then applied on top and self-adhesive tape applied at corner junctions to create air-tightness barrier

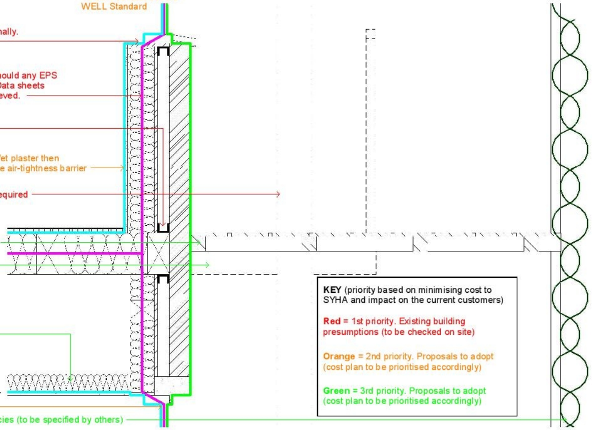
All existing rain water goods to be assessed and repaired locally where required

Replacement communal perimeter balconies made from light-weight permeable structure. Structure to be fixed back to existing external wall.

Dashed line denotes existing individual balconies to be removed

Mineral wool insulation to be installed above existing tiled ceiling **during a further retrofit depending on further improvements to the UK's building regulations**. Mineral wool specification TBC but must ensure overall U value achieved meets or betters that for 'Roof' within Table 2 of AD-L1A. All existing ceiling tiles to be retained during installation process and reinstated

Mastic to be applied internally and externally at head and cill level of existing windows to minimise heat lose



PROPOSED GREEN BUFFER ZONE/INTERMEDIATE FLOOR DETAIL
(1:75 @ A1)

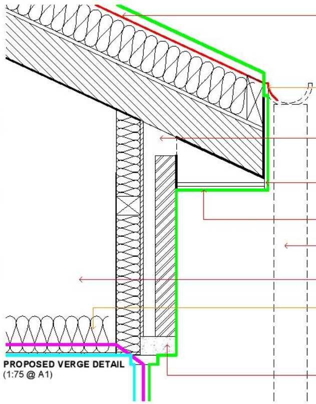
Green wall to be attached to proposed balcony using 'climbing' plant species (to be specified by others)

KEY (priority based on minimising cost to SYHA and impact on the current customers)

Red = 1st priority. Existing building presumptions (to be checked on site)

Orange = 2nd priority. Proposals to adopt (cost plan to be prioritised accordingly)

Green = 3rd priority. Proposals to adopt (cost plan to be prioritised accordingly)



PROPOSED VERGE DETAIL
(1:75 @ A1)

Red line denotes presumed existing waterproof membrane. Existing roof tiles to be lifted to inspect condition and membrane and localised repairs conducted where required

Possible additional waterproof membrane to be installed underneath existing by approx. 50mm across roof perimeter to ensure water runs off into gutter

Presumed detail to be checked on site. Top coarse of brick work to be removed to allow for cavity ventilation gap

Presumed existing uPVC fascia and soffit boards to be secured on site and replaced where required with timber painted in white to match existing

Presumed existing ventilation gap with insect mesh. To be checked on site and installed where required

All existing rain water goods to be assessed and repaired locally where required

All existing roof spaces to be treated as unheated

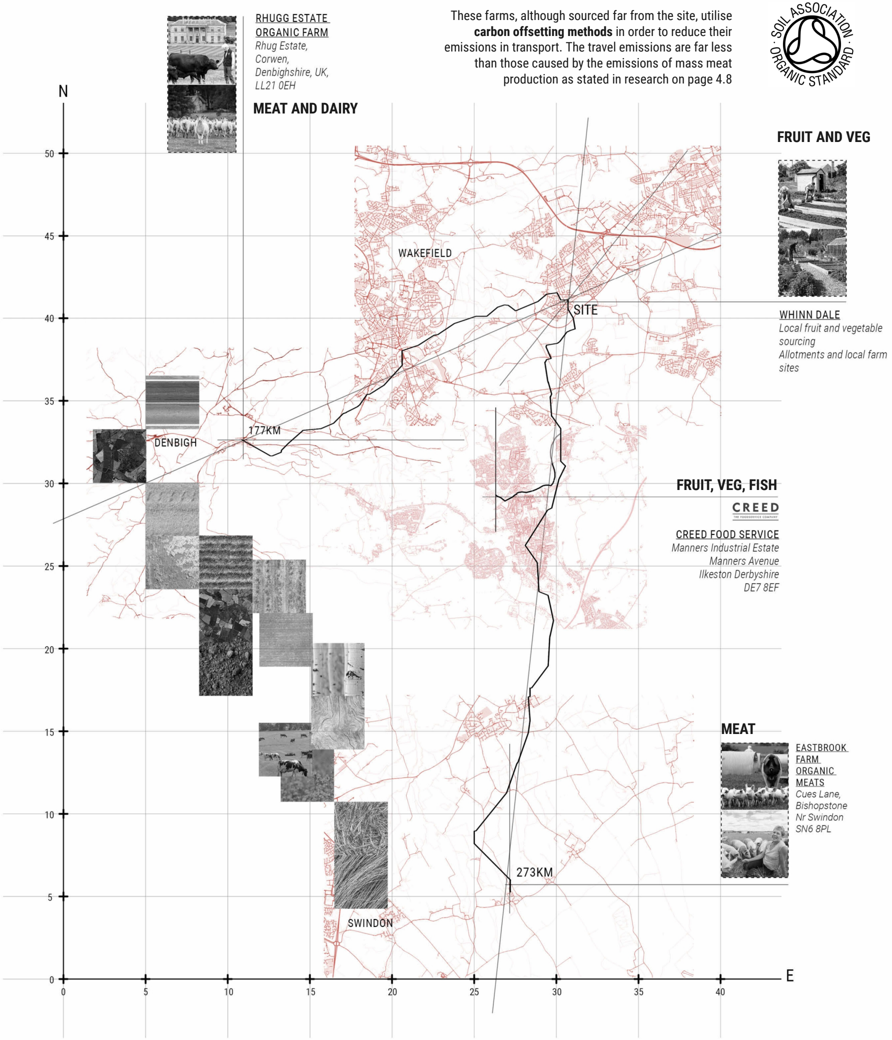
Mineral wool insulation to be installed above existing tiled ceiling. Mineral wool specification TBC but must ensure overall U value achieved meets or betters that for 'Roof' within Table 2 of AD-L1A. All existing ceiling tiles to be retained during installation process and reinstated

Assumed existing concrete lintel

Solutions

7.15 Sustainable and Ethical Food Sourcing

These farms, although sourced far from the site, utilise **carbon offsetting methods** in order to reduce their emissions in transport. The travel emissions are far less than those caused by the emissions of mass meat production as stated in research on page 4.8



> *Climate Change Committee (2020) suggests a **reduction of all meat consumption of 20% by 2030** and 35% by 2050.*
> *A 50% reduction in the amount of meat produced and eaten in the UK by 2030 and the remainder to be "better".*
>
> *This means produced to **high environmental and animal welfare standards**. Diets lower in animal products are also better for our health.*

ENVIRONMENTAL STANDARDS TO CONSIDER:

- Locally sourced meat and dairy for lower carbon footprint in food miles
- Quality over quantity meaning less consumption of these products but better quality when consumed
- Sources that are considering their carbon footprint
- Organic farming - it is friendlier to the environment so there is a much greater diversity of birds, butterflies and plants on organic farms.

MEAT AND DAIRY SOURCES:

Figure 56: Organic Meat Farm - Helen Browning

Helen Browning's Eastbrook Organic Meat Farm - soil association organic standard

- Although sourced from a large distance across country in Swindon, they are a progressive farm focusing on offsetting their carbon emissions via:
  - Planting of trees
  - Experimenting with agroforestry and orchards
  - No ploughing of the land
  - Working with soil association to experiment with the use of trees and new technologies/research on the farm

Rhugg Estate Organic Farm - soil association organic standard

- Although sourced from a large distance across country, again, they are focusing on offsetting their carbon emissions via:
  - A solar farm installed in 2011
  - Two on-site wind turbines
  - Air and ground source heat pumps to all properties on the estate
  - Hydro-power in the form of a water turbine installed in the lake
  - Compostable and recyclable packaging

If SYHA can source meat from these companies in bulk and less frequently, they are ensuring better quality products and also reducing embodied carbon emissions

ETHICAL STANDARDS TO CONSIDER:

According to **Compassion in World Farming's** standards analysis (Compassion in world farming & OneKind, 2012), analysed certification of meat, dairy and fish production standards against the 5 criteria:

1. *Freedom from hunger and thirst by ready access to fresh water and a diet to maintain full health and vigour*

2. *Freedom from discomfort by providing an appropriate environment including shelter and a comfortable resting area*

3. *Freedom from pain, injury or disease by prevention or rapid diagnosis and treatment*

4. *Freedom to express normal behaviour by providing sufficient space, proper facilities and company of the animal's own kind*

5. *Freedom from fear & distress by ensuring conditions and treatment which avoid mental suffering.*

Standards in order of excellence:
1 SOIL ASSOCIATION
2 RSPCA Freedom Food
3 Scottish Organic Producers Association

Creed Food Service - source of fruit, veg, fish and dairy

- Soil Association Organic certification
- Located in Derbyshire, closer to site
- RSPCA certification
- Food delivery in bulk for catering is appropriate for SYHA which also means lower embodied carbon due to less trips
- Collects and provides safe disposal of both oil and food kitchen waste for SYHA through Olleco (partner company)
- Tracks their carbon footprint digitally, for customers to see

Summary

- SYHA should source meat and dairy **less often** but of **better quality** to improve health and benefit the environment
- **2 farms and 1 distributor** have been located in the UK to source soil association organic standard certified products which ensures **ethical and sustainability standards**
- These farms and distributors, although sourced far from the site, utilise **carbon offsetting methods** in order to reduce their emissions which could help in offsetting embodied carbon in transport

7.16 Landscape Masterplan

BREEAM	COSTING - £44,850.98	COSTING - £28,300.00
- **LE02 Protection of ecological features** - one credit - **LE04 Enhancing site ecology** - Ecologist's report and recommendations - one credit	**Wetland** and **Woodland** - £25 - 30/m3 For 1485.49m3 of Wetland and Woodland - **£40,850.98** Planting (labour) - £25/hr For 160 hours of labour - **£4000**	**Allotments** (Weeding labour) - **£20 - 30/hr** Top soil - **£60 - 90/ bag** Compost - **£4 - 8/bag** Weedkiller - **£1 - 20/bag** Required for 1025.14 m2 (300 bags) + 5 days labour

AIMS

Increase positive response through seasonal events by introducing early spring flowering herbaceous understory and woodland edge planting around the path

Decrease negative experience in winter by introducing evergreen species

Support biodiversity of birds and bats through diversification of tree species

Increase range of habitat types and potential to support pollinators by creating a more complex woodland structure

A STRONG MANAGEMENT PLAN IN PLACE

The most successful species will takeover (for example, long grasses, ash trees and norway maples) which will limit biodiversity

Coppicing and thinning will create biodiversity by opening the system up to sunlight to allow other species to grow

Aim to attract invertebrates, which will then attract other species like birds with:

- Pond or small body of water
- Wild flowers and variety of plants
- Bird nesting

- **Woodland** *(and woodland edge)*
- **Wetland** *(and wetland edge)*
- **Wet woodland** *(due to the surrounding land being small we will need to merge the two)*
- The **edges** are where *the most complexity occurs*

TREE SPECIFICATION

- Must include a vast range of **different species**
- Include **saplins** (trees less than a year old, or young trees) as they will establish themselves in the soil and it is cheaper than importing old trees
- Do not use old trees as:
  1. Some adult trees will not established themselves in the soil
  2. Severing old trees emits carbon in transmission and it is not environmentally friendly
  3. It is more costly
- **Overplant** - as most of them will die
- Plant native trees **south of Wakefield** to survive a warming climate
- **Mixed broadleaf deciduous** woodland lose their leaves in winter which will allow for more sunlight to reach the building in the winter

Figure 57: Green infrastructure - landscape management

Summary

- It is important to have a **strong management plan** in place
- Landscaping will be **cost-efficient** with benefits for the environment and the users
- Inclusion of a **mosaic habitat** will help to create a thriving eco-system with lots of **bio-diversity**
- High **consideration** needs to be done for the location of the allotments, the woodland, wetlands and wet woodlands. Also, consideration of specific trees and plants for placement in wet and dry soils.

Solutions

7.17 Landscape Masterplan

BUFFER ZONE

The buffer zone creates a micro-climate, saving the energy needed to cool the interior. At the same time the timber frame acts as a balcony for the residents.

Honeysuckle will be used to climb up the buffer as it is a non-invasive, deciduous plant. This allows light in during the winter and protection from overheating during the summer.

EXISTING VEGETATION

This area will be left as it is, as young saplings and vegetation have been planted recently and need time to mature.

ZONE B

Zone B is higher on the site, meaning the soil is drier and less prone to surface water build up. However it must still tolerate flood risk as extreme weather will still affect this area. Therefore the soil parameter was set to moist/ very moist to locate trees that can tolerate this and 2080 predicted climates.


Coast Redwood


Lawson's Cypress


Common Alder


White Willow


Corsican Pine


European Larch


Oriental Spruce


Western Red Cedar

Including also Red Oak and Macedonian Pine

ZONE A & B

Herbaceous ground cover for wet, moist and damp soil types


Evergreen and semi-evergreen ferns from western Europe


Holly tree


Ramsons and Wild Garlic


Foxglove


Common Bluebell

(Aimas, 2021; Forest Research Decision, 2021; Hirons & Sjöman, 2019)

COMMUNITY ALLOTMENTS

- An area with a good amount of morning sunlight and shade in the afternoon is most ideal
- 6 to 8 full hours of sunlight.
- Soil testing for contaminants must be undertaken

Top down approach from SYHA, they would organise and put it together (benefit of this would be potential for more profit for SYHA through membership fees)
Grassroots approach involves organisation amongst the users (benefit of this is that the community would have to come together to form agreements and rules)
Combination approach (benefits both SYHA and the user. This could involve a combination of top down organisation and with membership fees involved as well as input from the users so that all needs are met)

BIOSWALES

A mitigation measure located at the lowest point on the site to prevent future extreme flooding within the site and its neighbourhood

A green corridor, protects users from air pollution through multi-layered planting, achieves urban cooling through increased greenery, promotes health and wellbeing, creates habitats and protects the ecosystem.

ZONE A

Zone A is the lowest point on site and the location for the proposed bioswales. Therefore the vegetation and tree species must be able to tolerate extremely wet soil types and mitigate flood risk. Therefore the soil parameter was set to wet/very wet to locate trees that can tolerate this and 2080 predicted climates.


Common, Red, Grey, and Italian Alder


Willow Oak


Black Poplar


Lodgepole Pine


Aspen


Sitka Spruce


Cider Gum

POND

The pond provides a water storage and supply as a part of the rainwater harvesting system implemented on the roof

It also aids in the enhancement of bio-diversity of the eco-system by providing a habitat for invertebrates, which will then attract other species like birds.

7.18 Landscape Management Plan

Goal 1
Increase plant species diversity for biodiversity and climate change resilience: reduce pioneer species and increase climax, aiding succession

Goal 2
Increase biodiversity by establishing a more complex spatial/canopy structure with mixed ages

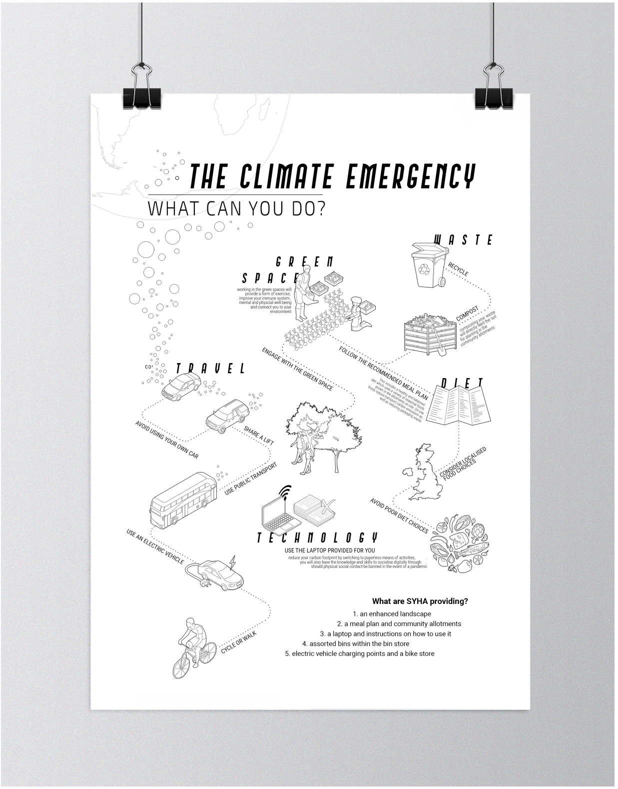
Goal 3
Establish herbaceous ground cover to increase year-round positive emotional response and support pollinators

(Aimas, 2021; Forest Research Decision, 2021; Hirons & Sjöman, 2019)

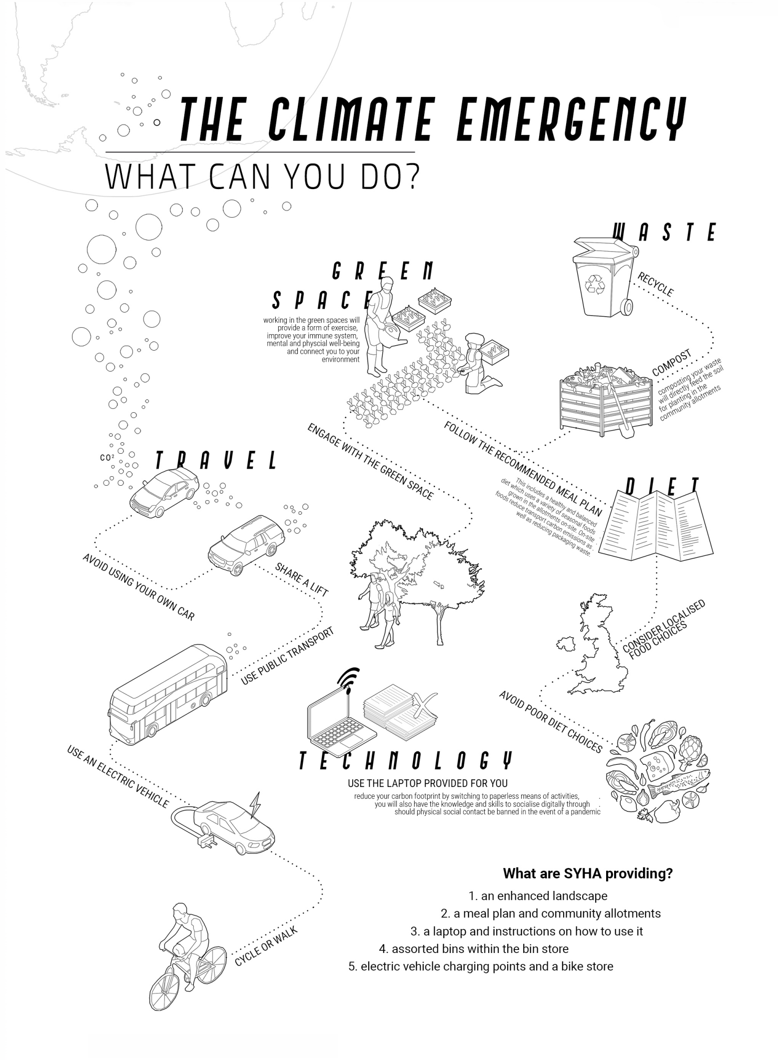
	Goal 1	Goal 1	Goal 2	Goal 3	Goal 3	Goal 3	Goal 3
1 ACTION	Thinning of dominant species to allow light in to the system In all cases: cut to groun and paint with glyphosate	Plant 1-2 year old seedlings 6-8cm girth bare root: Zone A: *Common alder, Red alder, Grey alder, Sitka spruce, Lodgepole pine* Zone B: *Corsican pine, Oriental spruce, European larch, Western red cedar, Lawson's cypress, red oak, White willow* All by hand to prevent compaction Tree stakes drive 50cm into ground	Coppice existing trees cutting stems close to ground This will help to establish a mosaic habitat	Cut ilex aquifolium (holly tree) to ground level	Plant asplenium scolendrium and polystichum setiferum (evergreen ferns) from 9cm pots	Sow lower edge with 6g/ m2 of Digitalis purpurea (foxglove) target density: 50-65 plants per m2	Plant allium ursinum (ramsons) and Hyacinthoides non-scripta (common bluebell): plant geophytes and backfill by hand Target density: >10 plants per m2, to gradually spread across entire area
2 WHEN	First year, then every 5 years	After coppicing takes place (every 3 years)	In winter while tree is dormant Every 3 years, in a new area each time, before rotating back to the first (after 18 years)	Every 3 years	Year 1 Assess every 3 years, replant if density is below 3 in 10m2. If population falls below 1 in 10m2 or either species is absent, re-assess species choice of shade tolerant evergreen ferns.	Late september Assess in 3 years for evidence of self seeding. If density is below target then re-seed. Re-assess speciesif density below 10 plants per sq m	Year 1 Assess every 3 years, if failing to spread re-assess species choice
3 TO WHAT/WHERE	All existing trees and fully established trees, 60% of all vigourous species between 15-60cm girth. Fell more of the most dominant so that the remaining amount of each species is balanced In addition, thin ALL saplings of dominant weedy species (below 15cm girth)	Across zones A and B at 1.5m spacing including existing trees	All trees <60cm girth in a given 10mx10m area. Rotate areas to be coppiced.	All ilex aquifolium across zones a, b and ground	zones a and b as one cluster of 3 in every 10m2	Bioswales, zone a	Allium Ursinum in zone A in 8 2x2m clusters Hyancinthoides non-scripta in zone B in 8 2x2m clusters
4 APPROX COST (HOURS OF LABOUR PER 100M2 OR PER UNIT	1hr per tree 0.5hr per 1m2 of saplings	0.35 hours planting and backfilling per tree 0.2 hours staking 0.55 hours total per tree	1 hour per tree	0.5 hrs/m2	0.1 hours per plant	0.25 (for 5gm)/m2	0.5 hr/m2
5 AREA TO BE TREATED/NUMBER OF PLANTS	Approx 20 trees + 30m2	Approx 60 trees	Approx 15 trees	Approx 45m2	210 plants	50m2	72m2
6 TOTAL LABOUR PER YEAR (HRS)	4	11	5	7.5	7	12.5	36 (year 1 only)

Solutions

7.19 Poster for Residents



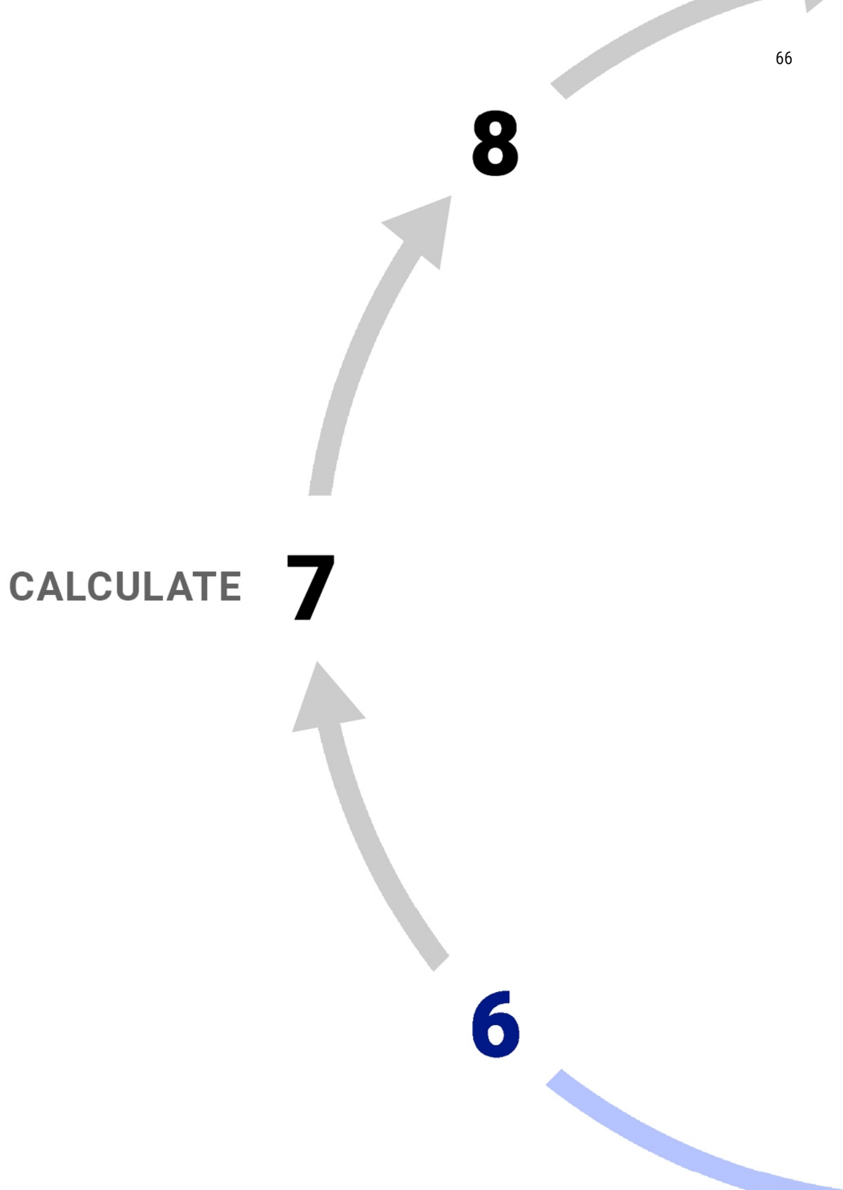
It is important, in order to maximise the benefits of all the framework proposals, that the users understand the system that has been put in place by SYHA to work with them. When a top down approach is taken, combined with enthusiasm and drive from the bottom up, then there is a higher chance that the environmental sustainability goals are reached. The poster is a great way to engage and inform the user of these strategies.



Solutions

SUSTAINABILITY FRAMEWORK

Through the use of Sofie Pelsmakers' Climate Emergency Design Themes, the existing and proposed themes will now be assessed to see if energy consumption at both end-user and building level has been reduced.



8.1 BREEAM

Column1	Credits Achieved	Credits Avaiable	% of Cesdits Achieved	Section Weighting	% Section Score
Management	20	21	95.24%	12.0%	11.43%
Health and Wellbeing	16	17	94.12%	15.0%	14.12%
Energy	23	34	67.65%	19.0%	12.85%
Transport	9	12	75.00%	8.0%	6.00%
Water	8	9	88.89%	6.0%	5.33%
Materials	13	13	100.00%	12.5%	12.50%
Waste	7	12	58.33%	7.5%	4.38%
Land use and Ecology	4	5	80.00%	10.0%	8.00%
Pollution	13	13	100.00%	10.0%	10.00%
Innovation	1	10	10.00%	10.0%	1.00%
					85.61%

BREEAM Rating	% score
OUTSTANDING	≥85
EXCELLENT	≥70
VERY GOOD	≥55
GOOD	≥45
PASS	≥30
UNCLASSIFIED	<30

New table

BREEAM issue	Outstanding Minimum standards	check
Man 03	Two credits	V
Man 04	Criteria 9 (Building User Guide)	V
Ene 01	Ten credits (energy improvement>60%)	V
Ene 02	One credit	V
Wat 01	Two credits	V
Mat 03	Criteria 1 only	V
Wst 01	One credit	V
Wst 03	One credit	V

Summary

- This project is expected to achieve the **outstanding level of rating**, which is a score **above 85%**.
- Rating outcome assumed the proper management and efficient construction throughout the project life.

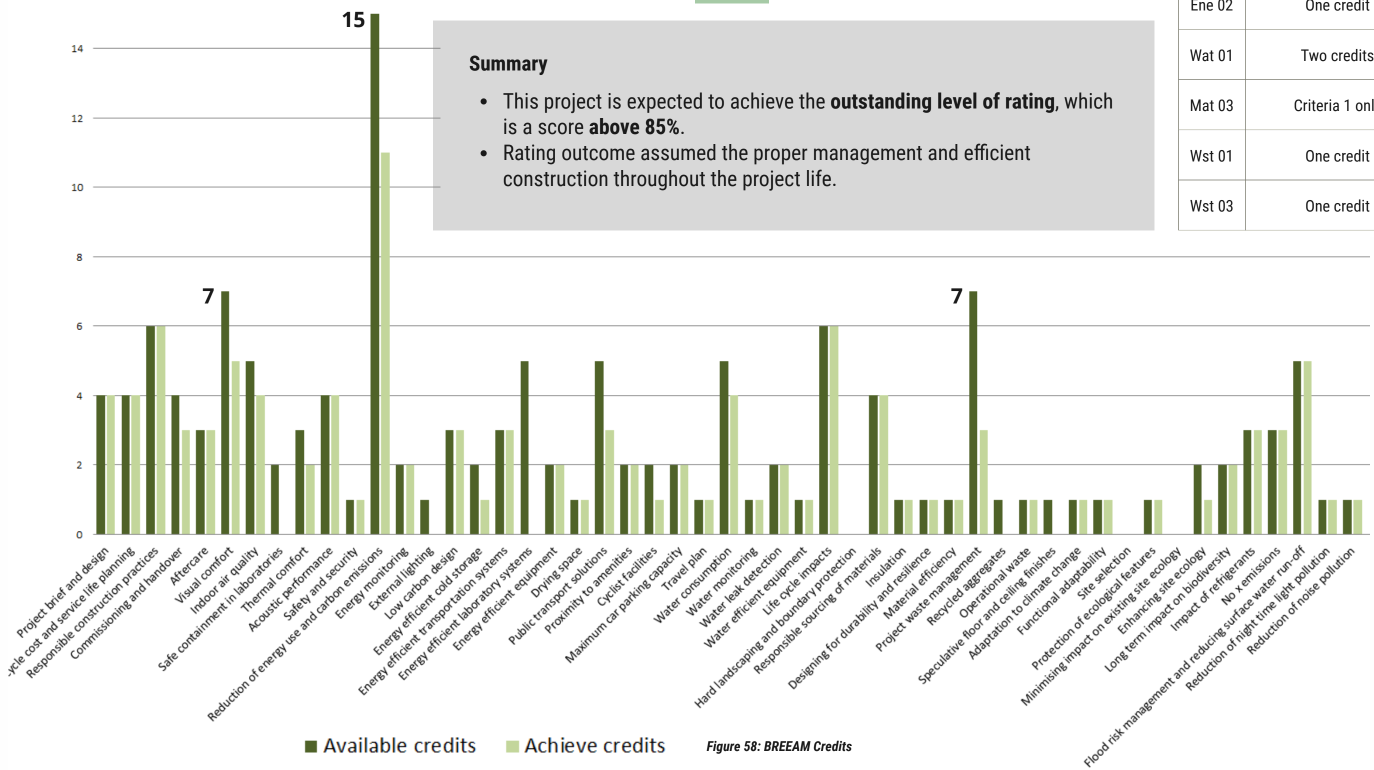


Figure 58: BREEAM Credits

Calculation

8.2 Cost Analysis

COSTING LIST - *Based on* ***climate emergency design priority*** *and* ***SYHA's budget***

ITEM	REQUIRED QUANTITY	TOTAL COST
Wetlands and Woodlands	1485.49m3	£44,850.98
Bioswales	780.96m2	£9,762.00
Allotments	1025.14m2	£28,300.00
Green Walls	90.2m	£935.52
Solar Panels	2081.22m2	£658,184.30
NVHRC	3 units	£13,950.00
Ventilation Shaft	1 unit	£10,702.00
Bike Store	5 units	£4,470.00
Electric Vehicle Charge Points	8 units	£4,392.00
Buffer Zone	90.2m	£25,055.56
Rain Water Harvesting and Retention Pond	1 each	£97,829.40
Skylight	1485.49m3	£3,634.50
Water proofing membranes	2081.22m2	£10,731.10
Insulation above ceiling tiles	1485.49m3	£10,731.10
Total - Excluding Solar Panels		***£265,344.16***
Total - Including Solar Panels		***£923,528.46***

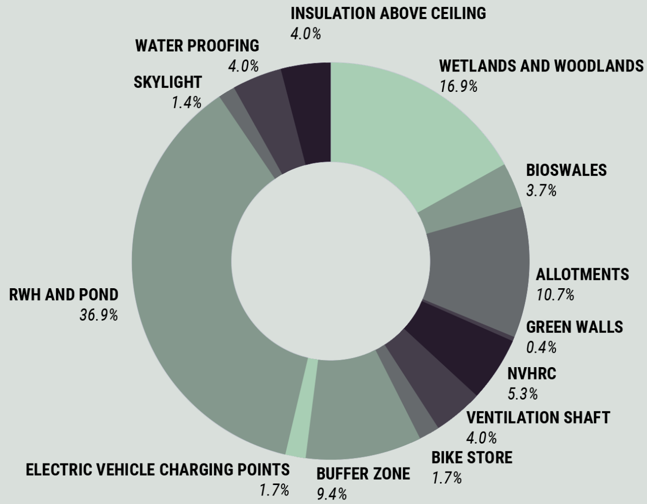


Figure 59: Cost Distribution

COSTING - £935.52
Green walls (honeysuckle) - £7.60/m
Green walls (labour) - £25/hr
Total for west wall (90.2m for 10 hrs labour cost) - **£935.52**

COSTING - £9,762.00
Bioswales (honeysuckle) - £10-15/m2 including labour
Total for Bioswales (£12.5/m2 for 780.96m2) - **£9,762.00**

COSTING - £21,462.2
Weather/ Water proofing - £5/m2 (2081.22m2 required)
Insulation and Air tightness - £5/m2 (2081.22m2 required)
Labour - 150-175/ day (4 days required)

COSTING - £97,829.40
Advance Rainwater harvesting system (includes water butts, installation and connection pipe) - £45/m2
Total for **Rainwater harvesting system** (for 2081.2m2) - **£93,654.00**
Retention (wet) pond - £15 - 25/m3
Total for **Pond** (of 208.77 m3) - **£4175.40**

COSTING - £28,300.00
Allotments (Weeding labour) - **£20 - 30/hr**
Top soil - **£60 - 90/ bag**
Compost - **£4 - 8/bag**
Weedkiller - **£1 - 20/bag**
Required for 1025.14 m2 (300 bags) + 5 days labour

COSTING - £10,702.00
Decommissioning a lift - £10,000/lift
Damper - £234/piece
For ventilation shaft with 3 dampers - **£702.00**

COSTING - £25,055.56
Buffer zone (primary timber frame) - £25.22/member
Required 144 members - **£3,631.68**
Buffer zone (square lattice) - £25.50/member
Required 282 members - **£7,191.00**
Timber frame labour - £2-5/m2
Labour (for 530m2) - **£1,855.00**
Balcony Decking slab - £12 - 21/m2
Decking slab (for 339.12m2) - **£5,595.48**
Balcony slab labour - £20/m2
Labour (for 339.12m2) - **£6,782.40**

COSTING - £13,950.00
NVHRC (Unit) - **£1500/unit**
Labour cost for designing - **£550.00**
Labour cost for installing - **£2,000.00**
Cost for commissioning - **£600.00**
3 units required (one per floor)

COSTING - £3,634.50
Skylight (HR++ glazing) - £110/m2
HR++ glazing for 24m2 - **£2,640.00**
Skylight frame - £390/m2
Frame for 2.55m2 - **£994.50**

COSTING - £44,850.98
Wetland and **Woodland** - £25 - 30/m3
For 1485.49m3 of Wetland and Woodland - **£40,850.98**
Planting (labour) - £25/hr
For 160 hours of labour - **£4,000.00**

COSTING - £658,184.30
Solar panels - £315/m2 (2081.22m2 required)
Labour - 200/day (13 days required)

COSTING - £8,862.00
Bike store - £894/rack (5 numbers required)
Electric vehicle charging points - £549/piece (8 required)

Calculation

8.3 Existing Themes

END-USER
BUIDING

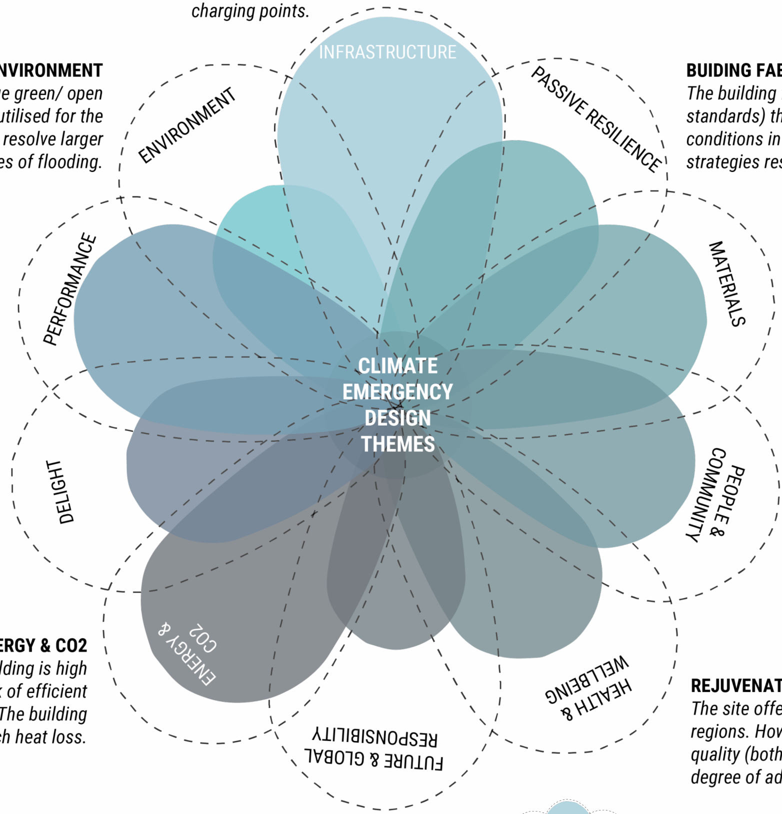
STANDARD LEVELS
To help identify if the existing/ proposed framework falls above or below standards

URBAN NETWORKS | INFRASTRUCTURE
The site can be accessed via public transport (buses). However, there is currently no allowance for cycle storage (limiting carbon neutral infrastructure) or electric vehicle charging points.

ECOSYSTEM & BIODIVERSITY | ENVIRONMENT
Currently, the site accommodates a large green/ open area. However, these boundaries are not utilised for the purpose of improving the biodiversity or to resolve larger neighbourhood level issues of flooding.

BUIDING FABRIC | PASSIVE RESILIENCE
The building fabric has been designed efficiently (above standards) therefore providing comfortable indoor conditions in winter months. However, lack of ventilation strategies results in summer overheating.

APPROACH | PERFORMANCE
The EPC Certificate shows a C (borderline B rating of 79/100) - this adheres with SYHA's fabric first approach



LOW IMPACT AND EFFICIENCY | MATERIALS
Whilst the external walls and roof pass current U value standards (AD-L1A), there is still room for improvement. The existing ground floor construction, however, currently fails the U value requirements as stated in AD-L1A.

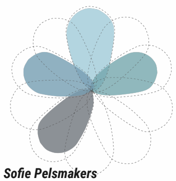
SENSES | DELIGHT
The design does not account for spaces that improve visual, auditory or tactile connections. Thermal comfort imbalance in the summer can further result in a reduction to these sensations.

ENGAGEMENT | PEOPLE & COMMUNITY
The building has been designed keeping the accessibility needs of its end-users in mind. However, the dense layout results in a lack of overlap of spaces between the occupants and the carers. Social engagements will be hindered indoors due to the pandemic. Therefore, building level, community engagement spaces are required.

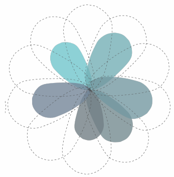
CLEAN ENERGY & EFFICIENCY | ENERGY & CO2
The energy usage is of the building is high (417kWh/m2/yr). This mostly due to the lack of efficient HVAC systems and renewable systems. The building fabric is fairly good however there is much heat loss.

REJUVENATION | HEALTH & WELLBEING
The site offers visual delight in terms of landscaped regions. However, effective strategies for improving Air quality (both indoors and outdoors) are missing. Higher degree of adaptibility is also not accounted for.

CLIMATE RISK MANAGEMENT | FUTURE & GLOBAL RESPONSIBILITY
The site offers huge potential for strategies that mitigate present and future climate risks such as flooding. Currently, no strategies are in place - incresing the possibilities of local floods. The building performs poorly in terms of rainwater harvesting & plumbing issues as a result of excessive precipitation.



PROS
Urban
Infrastructure
Performance
Energy & CO2
Materials



CONS
Environment
Passive Resilience
People & Community
Responsibility
Delight

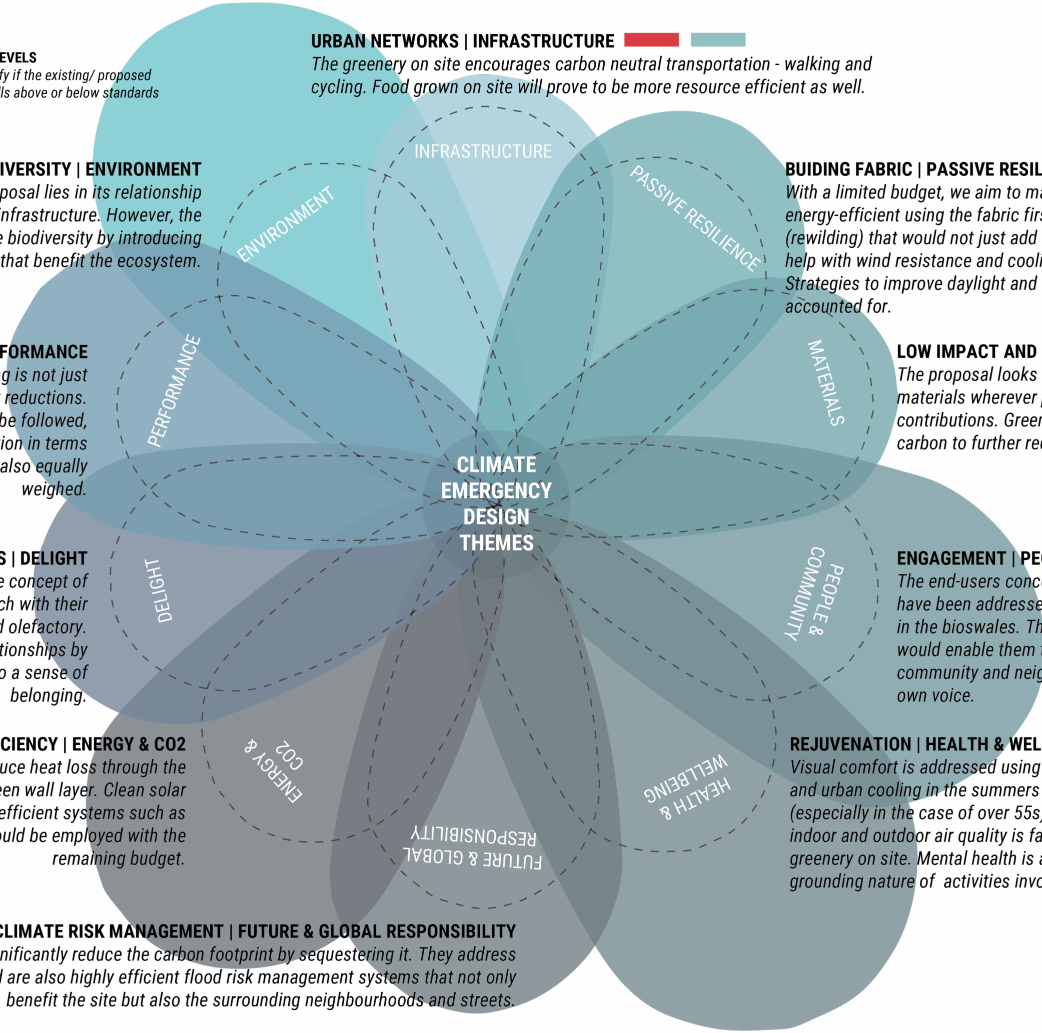
Figure and Text: Base Petal reference from Climate Emergency Design Themes - Sofie Pelsmakers

Figure 60: Climate Emergency Design Themes - Sofie Pelsmakers

8.4 Proposed Themes

STANDARD LEVELS
To help identify if the existing/ proposed framework falls above or below standards

END-USER
BUIDING



URBAN NETWORKS | INFRASTRUCTURE
The greenery on site encourages carbon neutral transportation - walking and cycling. Food grown on site will prove to be more resource efficient as well.

ECOSYSTEM & BIODIVERSITY | ENVIRONMENT
The essence of the proposal lies in its relationship between the green and social infrastructure. However, the greens also vastly improve biodiversity by introducing several habitats that benefit the ecosystem.

BUIDING FABRIC | PASSIVE RESILIENCE
With a limited budget, we aim to make the building more energy-efficient using the fabric first approach - green walls (rewilding) that would not just add to the visual appeal but also help with wind resistance and cooling - a low cost solution. Strategies to improve daylight and ventilation have also veen accounted for.

APPROACH | PERFORMANCE
The performance of the building is not just approached in terms of energy reductions. Although a fabric first approach will be followed, people satisfaction and global contribution in terms of mitigating future climate risks are also equally weighed.

LOW IMPACT AND EFFICIENCY | MATERIALS
The proposal looks to reuse the building's existing materials wherever possible to avoid landfill contributions. Greenery on site also helps sequester carbon to further reduce the carbon impact.

SENSES | DELIGHT
The proposal revolves around the concept of grounding to enable users to be in touch with their senses - visual, tactile, auditory and olefactory. Improving user-user and user-carer relationships by means of gardening greatly adds to a sense of belonging.

ENGAGEMENT | PEOPLE & COMMUNITY
The end-users concerns of lonliness and detachment have been addressed by means of communal gardens in the bioswales. This form of participatory design would enable them to feel as part of a larger community and neighbourhood - giving them their own voice.

CLEAN ENERGY & EFFICIENCY | ENERGY & CO2
The proposal aims to reduce heat loss through the fabric with the help of a green wall layer. Clean solar energy is also harnessed and efficient systems such as ground source heat pumps could be employed with the remaining budget.

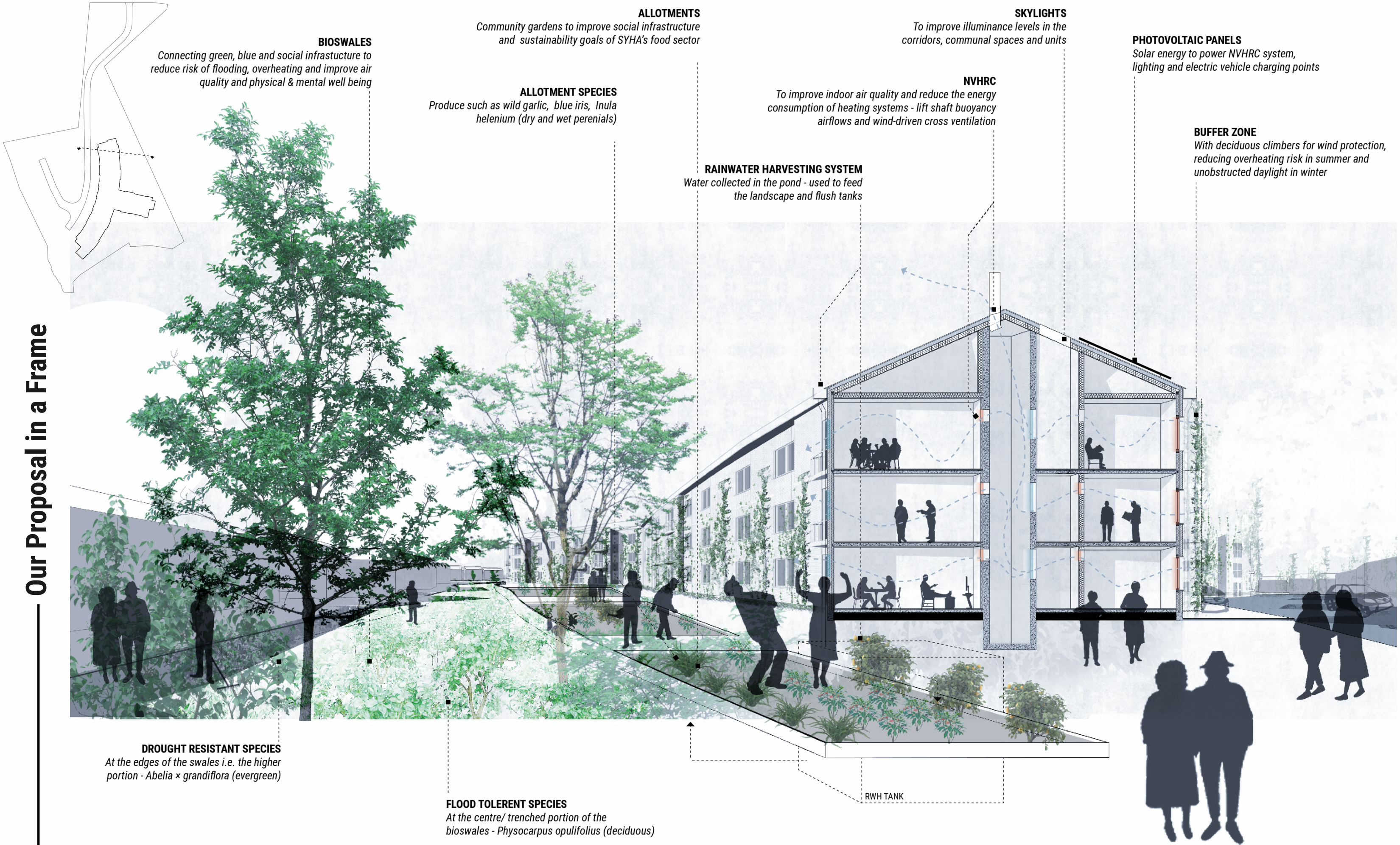
REJUVENATION | HEALTH & WELLBEING
Visual comfort is addressed using biophilia strategies and urban cooling in the summers prevents heat strokes (especially in the case of over 55s). Improvement of both indoor and outdoor air quality is facilitated by the greenery on site. Mental health is also addressed by the grounding nature of activities involved in the gardening.

CLIMATE RISK MANAGEMENT | FUTURE & GLOBAL RESPONSIBILITY
Rewilding and Bioswales significantly reduce the carbon footprint by sequestering it. They address future risk of overheating and are also highly efficient flood risk management systems that not only benefit the site but also the surrounding neighbourhoods and streets.

Figure and Text: Figure and Text: Base Petal reference from Climate Emergency Design Themes - Sofie Pelsmakers

Figure 61: Climate Emergency Design Themes - Sofie Pelsmakers

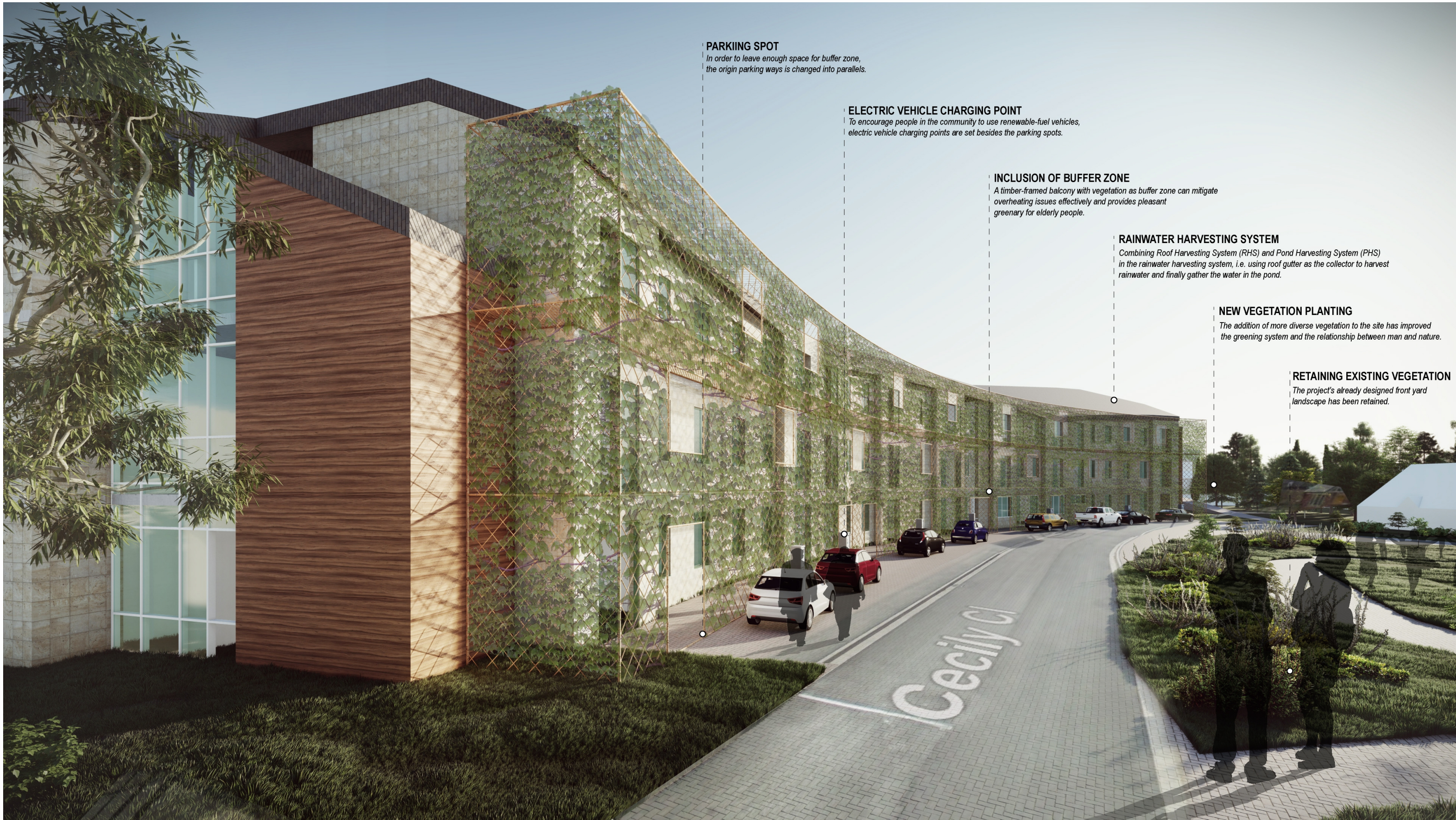
8.5 Environment Section | Visual



Species referenced from https://www.rhs.org.uk

8.6 Exterior Visual

West facade (exterior), **front landscape and buffer zone**
The visual shows the buffer zone added to address the overheating on the west facade, as well as the newly formed additional balcony.

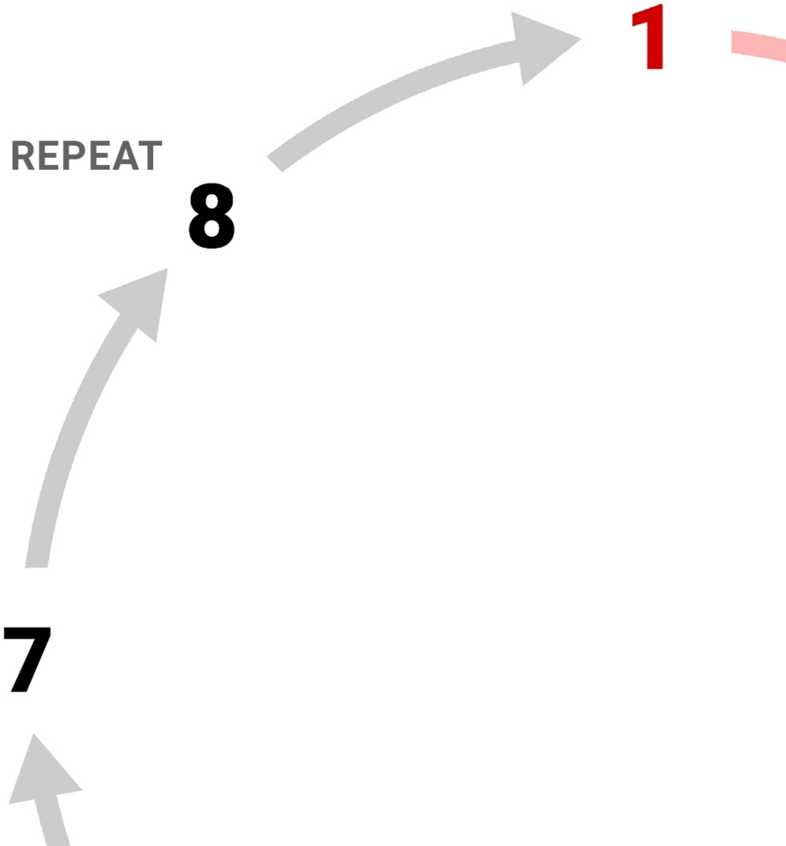


8.7 Exterior Visual

Private balcony/ Flat 1F
The balconies consists of a wooden frame and a wooden grille with honeysuckle on the outside, providing a comfortable environment inside and creating a semi-private balcony.

8.8 Exterior Visual

Private balcony/2F
The balcony roof on the 2nd floor is also covered by honeysuckle to help reduce the effects of intense solar radiation. At the same time, the partitions between the neighbours can be customised and have been decided to be closed or linked.



SUSTAINABILITY
FRAMEWORK

For future reviews of SYHA's extra care housing stock, we recommend that the sustainability framework is continuity repeated to ensure factors contributing to the climate emergency and potential future pandemics are addressed

9.1 References

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Figure 60: Climate EmergencyDesign Themes by Sofie Pelsmakers

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